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Electrical World

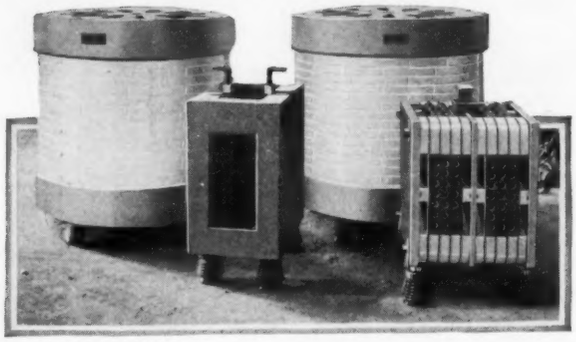
McGraw-Hill Company, Inc. December 12, 1925 Twenty-five Cents Per Copy

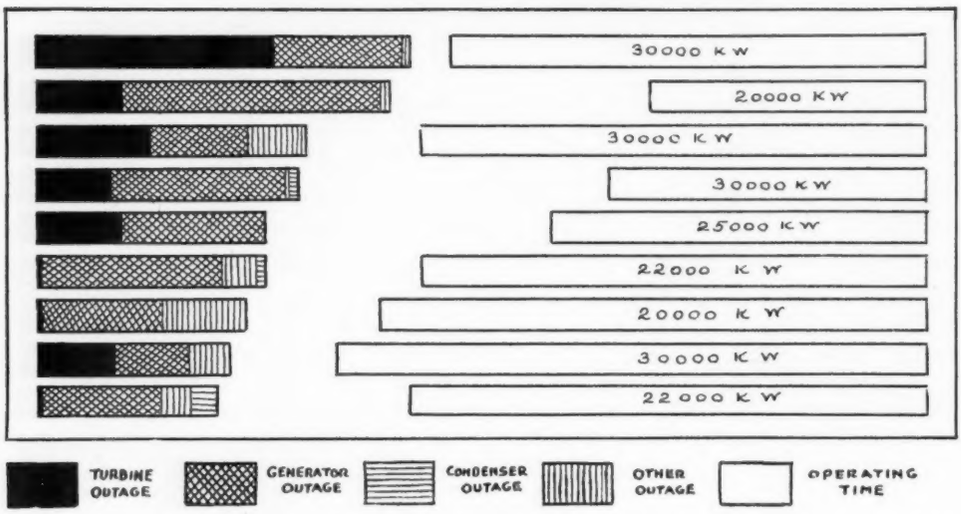
DEVELOPMENT of electrical energy by utilizing such natural forces as the weight of falling water or heat of burning coal has called upon man's ingenuity for marvelous machinery, extracting from the source of power the last possible kilowatthour. Equally essential for commercial application of the developed energy is a device for measuring its consumption to a fine degree of accuracy. Duncan Watthour meters are noteworthy for accuracy, both initial and sustained through years of service.

DUNCAN

ELECTRIC MANUFACTURING COMPANY, LAFAYETTE, INDIANA

Decrease Generator Outage
With Metropolitan Current Limiting Reactors





In the above graphic representation of the various causes which interfere with continuous generator operation, your system is perhaps included.

Why not protect yourself to obtain maximum continuous operating time? Your generators at least could be protected by Metropolitan Current Limiting Reactors.

List of Installations

Bronx Gas & Elec. Co., New York
Brooklyn Edison Co., Brooklyn, N. Y.
Brooklyn Rapid Transit Co., Brooklyn, N. Y.
Calgary Municipal Elec. Co., Calgary, Canada
Cataluna Power Co., Barcelona, Spain
Chicago Lake Shore & South Bend R. R.
Cohoes Light & Power Corp., Cohoes, N. Y.
Commonwealth Edison Co., Chicago, Ill.
Consolidated Gas Elec. Lt. & Pwr. Co., Baltimore, Md.
Dayton Power & Light Co., Dayton, Ohio
Detroit Edison Co., Detroit, Mich.
East Hampton Gas Co., East Hampton, Mass.
Edison Elec. Ill. Co., Boston, Mass.
El Paso Power & R. R. Co., El Paso, Texas
French General Electric Co., Paris
Hydro Electric Pwr. Commission, Toronto
Havana Elec. Ry., Lt. & Pwr. Co., Havana, Cuba
Illinois Steel Co., Gary, Ind.
Interborough Rapid Transit Co., New York
Kings County Gas & Electric Co., Brooklyn, N. Y.
Merced Irrigation Dist., San Francisco, Cal.
Municipal Gas Co., Albany, N. Y.
New York Edison Co., New York
N. Y., N. H. & H. R. R. Co.
N. Y. & Queens Elec. Lt. & Pwr. Co.
Philadelphia Electric Co., Philadelphia, Pa.
Potomac Electric Co., Washington, D. C.
Public Works Department, New Zealand
Public Service Electric Co., Newark, N. J.
Shawinigan Hydro Elec. Pwr. Co.
Southern Wisconsin Power Co., Madison, Wisc.
Tennessee Power Co., Chattancoga, Tenn.
Toledo R. R. & Lt. Co., Toledo, Ohio
Toronto Power Co., Niagara Falls, Ont.
Turners Falls Pwr. Co., Turners Falls, Mass.
United Electric Lt. Co., Springfield, Mass.
United Elec. Lt. & Pwr. Co., New York
Union Gas & Electric Co., Cincinnati
Union Elec. Lt. & Pwr. Co., St. Louis, Mo.
U. S. Explosive Plant, Nitro, West Va.
Utica Gas & Electric Co., Utica, N. Y.
Victoria Falls & Transvaal P. Co., Simerpan, South Africa
Westchester Lighting Co., Mount Vernon, N. Y.
Yonkers Elec. Lt. & Pwr. Co., Yonkers, N. Y.
Youngstown Sheet & Tube Co., Youngstown, Ohio

METROPOLITAN DEVICE CORPORATION
Manufacturers of the Murray Protective Devices
1250 Atlantic Avenue, Brooklyn, N .Y.

Electrical World

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W. H. ONKEN, JR.
Editor

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The Sixty-ninth Congress

A NEW Congress—the Sixty-ninth—with its political complexion little changed from that of the previous Congress, began its sessions this week. The work before it involves no major problems affecting the electrical industry. What is to become of Muscle Shoals and what will be the outcome of congressional deliberations over the Colorado River are minor considerations as regards the legislative calendar. The attitude of the administration as gleaned from the recent utterances of the President is to do all it can to insure a continuance of prosperity. Federal interference with business will be a minimum if President Coolidge has his way. Naturally the revenue bill comes uppermost in the minds of the public, assuring as it does generous reductions in taxes. All taxes increase the cost of production, and income taxes more than any other, for they fall like a dead hand on every worker. The Locarno conference will not be without beneficial effect in this connection.

The farmer as usual will clamor for aid, and Congress will be inclined to heed his cries. Efforts will also be made to have the federal government interfere in the present coal strike in the anthracite regions, but nothing is likely to be done toward federal regulation inasmuch as the mining of anthracite coal is wholly intrastate. While little sympathy should be wasted on either operators or miners, the public, in its anxiety to obtain anthracite coal, is prone to overlook the fact that government control would not make matters better, but worse. Economic pressure is stronger than political power and should be permitted full play. This is the first Congress under a strictly Coolidge administration, and, judging by the platform of a year ago, it is pledged to a conservative program. Much may be expected of it.

Private Enterprise Must Regard Its Obligations

THOSE who contend most vehemently for the rights of private enterprise oftentimes overlook the fact that rights carry obligations. It is when these obligations are flouted that people clamor for governmental intervention because they know of no other source of redress. Take the case of any public utility. So long as service at reasonable rates is forthcoming there is no tendency on the part of the public to complain. But if the service is poor and rates are exorbitant, the municipality is appealed to and the city enters the field, chiefly because private enterprise has failed to do its duty. Experience demonstrates that more often than not the cure is worse than the disease, but the damage is already done and private enterprise has itself to blame.

The Chamber of Commerce of New York has protested against any action by Congress looking toward the regulation of the coal industry. Here again the contention is against undue interference with private enterprise, and the American public is normally sympathetic with that point of view. But for years the supply of anthracite coal has been interrupted because of the troubles between the operators and the miners, and time after time the public has been forced to pay for a fight to which it is not a party. Naturally, if the coal-mining industry cannot compose its differences, the public in its dilemma turns to the government for relief. It may be undemocratic, it may be against all the tenets of American institutions, it may not be constitutional, but it is idle to imagine that any plea for private enterprise will avail so long as people shiver for want of fuel or are charged outrageously for the coal that speculators have succeeded in obtaining. The spirit of America is to encourage and favor private enterprise, but only so long as private enterprise refrains from abusing the privileges accorded it.

Fundamental Plans for System Developments

MANY metropolitan light and power companies have attempted to visualize their systems twenty-five years hence and have studied existing installations with the purpose of building for the future. But inevitably there is a great difference of opinion in regard to the best ultimate system and as to what steps should be taken to develop existing properties. Properties differ in local conditions and in existing layouts, and there are so many unknown elements to be weighed that the different utility groups cannot agree upon premises and conclusions.

Very few if any existing systems have been developed upon the basis of a well-studied plan. Nearly all started as embryo systems in densely loaded areas with direct-current supply and gradually extended as demands for electricity increased. Power houses, substations and lines were located where the load existed, and these elements were later co-ordinated upon the basis of expediency and temporary economies. As conditions change different parts of the system are changed to meet them. At present distribution systems are in the limelight and are being revamped to bring greater load-carrying possibilities. In some properties high-tension ring transmission lines or radial transmission lines are being built to get energy in larger quantities over larger areas and to insure better service reliability. Virtually all properties now are working upon some fundamental plan for development even though little agreement exists in the plans advocated.

Should synchronizing be done at the load or at the generating stations? Should ring or radial feeder systems be used? Should reactors be used freely or not at all? Should unit power stations with unit-load areas be the basis of development or should base-load stations be made available to all areas as they come into being? Should systems be built as tightly as possible or should

they be linked loosely together? These are typical questions asked and answered by those responsible for developments. And, since no one can prove his particular conclusions, each system builds in the way its responsible executives consider wisest.

It is encouraging to note that sufficient installations have been made and sufficient experience has been had to permit of some fundamental and universal deductions, and the near future should give some definite and accurate guides for system developments. In the meantime there is no cause for worry, for each installation works very satisfactorily and all plans are based on the premise that continuous service to customers is the primary consideration.

Pure Scientific Research Is a Necessary Development

LAST week Secretary Hoover, speaking in New York, made a severe arraignment of America. He said that while thousands of dollars and thousands of men were engaged in commercial research in this country, only meager funds and a few enthusiasts were engaged in pure scientific research; yet in his opinion a single discovery in pure science might prove invaluable, for the essential basis of real social and industrial progress is the ascertainment of new laws and new facts in the realm of pure science.

The reasoning of Secretary Hoover is sound, and the facts he adduced are disconcerting to a country which takes pride in its commercial and engineering achievements. It is not very encouraging to find the greatest scientific brains engaged in commercial research work in order to live and to discover that purely scientific research workers and laboratories play a negligible part in the activities of this prosperous industrial nation. The condition is due to thoughtlessness only, and the nation that produced a Cabinet member with the wisdom and vision of Secretary Hoover needs only to have its attention focused on a worthy cause to bring about improvement.

The Lion's Share

IN COMPUTING the operating expense of lighting we find that the major part is the cost of electrical energy. For example, for a well-designed installation of industrial lighting the cost of energy at 3 cents per kilowatt-hour is about 80 per cent of the total annual operating cost. At a 5-cent rate the cost of energy is about 87 per cent of this total cost. These high percentages also hold fairly well for most other lighting installations. It is obvious that the central-station company gets the lion's share from lighting; therefore it is logical to expect that the central station shall exhibit the lion's initiative.

A survey has shown that less than 10 per cent of consumers of lighting seek advice on illumination from the central-station company, whereas about 50 per cent seek advice from the electrical retailer and jobber. The figures speak eloquently of the truth that the central station should set the pace and the example by having its own well-organized lighting department. This is not a new movement by any means, but it has not attained its proper growth. With 80 to 90 per cent of lighting costs flowing into the central station, the company not only should do the lion's share, but should want to do it in order to see that it is done well and with an eye to the future. Of course, any aid that the central station can extend in developing outposts for lighting advice among retailers is helpful to every one, but the facts indicate that the company should lead the way with its own lighting department.

Take a Leaf from the Telephone Book

THE rapid progress of interconnection and co-ordination of central-station systems accentuates the importance of every form of development forecasting in the electric light and power industry. Good management has always demanded prevision as to the best lines of plant and system extension, but now we are in an era where longer-range planning of such additions and improvements is necessary. The problem is becoming more complex as electric service develops along regional instead of purely along local lines, and the best hope of light solution lies in co-ordinating the data, methods, men and material hitherto scattered, out of contact, antagonistic or indifferent to any comprehensive plan.

No finer example exists in the world of co-ordinating engineering and financial resources for the common welfare than the Bell telephone system of the United States. The fundamental service requirements are obviously not those of central stations. There is no "individuality" about a shipment of kilowatt-hours across a state boundary from a plant to a distant customer, and the identity of energy in an interconnected transmission system is of no importance. Because of this the detailed problems of telephone development planning are of little concern to the light and power engineer except as they bear upon such matters as inductive co-ordination, the joint use of poles and the supply of service to exchange buildings. On the other hand, the central-station man and the transmission-line builder have much to learn from the telephone engineer's broader methods of planning for future development.

In the October issue of the *Bell System Technical Journal* H. P. Charlesworth discusses "The General Engineering Problems of the Bell System" with a breadth of view well worth cultivating among electric light and power companies which have recently entered into the state of interconnection, fallen into the hands of centralized managers, or which are in line for such developments in the not distant future. The author's emphasis upon the necessity for advance planning to insure economical performance and satisfactory service, his review of the problem of building location, program scheduling, duct location and general plant anticipation based on commercial surveys and engineering forecasts fits admirably into the central-station picture. This investigation work is often done fifteen or twenty years in advance on the Bell system, but even if a much shorter period were covered in joint or co-operative central-station surveys applied to regional estimated trends of load, it would result in immense savings. Many of these developments must proceed on a piecemeal basis in the light and power field, but if those responsible for such work in our own industry will pool their ideas and data, fewer mistakes will be made—and mistakes in system development yield a bumper crop of capital wastes.

Joint engineering cost studies must find a basic place in this sort of co-ordination, and whether the control

of particular properties changes or not, it is of primary importance that future regional development shall proceed along economic lines, with the practical possibilities of interconnection and the comparative rough costs of acceptable schemes available to all concerned. The Bell system is being built up with the aid of intelligent local studies and planning, co-ordinated into a national service. The electric light and power industry is still very far from a continental development, notwithstanding the claims of some politicians, but it can wisely take a leaf from the engineering book of the telephone company as it feels its way into larger territorial usefulness.

Performance of Lines in Storm Areas

RECENT studies of operating experience on transmission lines crossing storm areas emphasize the fact that comparisons of performance of different lines should not be made without proper consideration of their respective directions with respect to the prevailing storm paths. One company operating two important trunk lines finds that flashovers, disturbances and potential interruptions may be 800 per cent greater on a particular line than on other lines operating under similar load conditions and provided with equivalent insulation. The tremendous discrepancy in the performance of these lines is laid to the fact that one line, showing only four cases of trouble in nine years, lies in a direction parallel to the prevailing storm path, while another line, giving considerable trouble from flashovers and disturbances, lies at right angles to the prevailing storm paths. Experience seems to support the belief that the first line is exposed only to that particular storm which travels in a path coincident with the route of the line, whereas the line running at right angles to the storm paths may be subjected to as many as eight or ten different storms, all of which pass over the line somewhere between terminals. The fact that all disturbances on the lines under comparison have been caused by lightning supports the argument that disturbances are proportional to the actual exposure of the line to lightning and that this exposure is in turn increased when the course of the line is such as to intercept more than one storm path.

Direct-Current High-Tension Power Transmission Again

BECAUSE of the well-known limitations of three-phase long-distance power transmission—limitations primarily due to the line inductance and capacitance—direct-current transmission at voltages of the order of magnitude of 100 kv. offers an attractive alternative. We say "transmission," because neither generation nor utilization of direct-current energy at such voltages is in the least attractive. In fact, if a good genie were to offer a large quantity of such energy gratis, the beneficiary would probably have to refuse it or to use it in resistances to heat water and generate steam for prime movers in order to convert it into mechanical energy. The advantages of high-tension direct-current transmission are such that inventors have had the temerity to offer bulky and complicated devices at both ends of the line in order to be able to produce and to utilize it. The first practical solution, proposed by Thury, consisted of a large number of direct-current machines in series. Then came Highfield's "transverter," or a special high-tension synchronous converter with revolving brushes.

Now D. C. Prince offers still another solution, based on the use of inverted electronic rectifiers or pilotrons, which he calls "inverters" (*General Electric Review*, 1925, Vol. 28, page 676). At the generating end high-voltage polyphase currents are produced in the usual manner by alternators and, after passing through step-up transformers, are converted into direct current by means of large two-electrode high-voltage kenotrons. At the receiving end similar but inverted kenotrons are used, with three electrodes, the grid being utilized for timing the conversion of direct current back into polyphase alternating currents of a desired frequency. A synchronous motor is used as a timer and also furnishes the required reactive power.

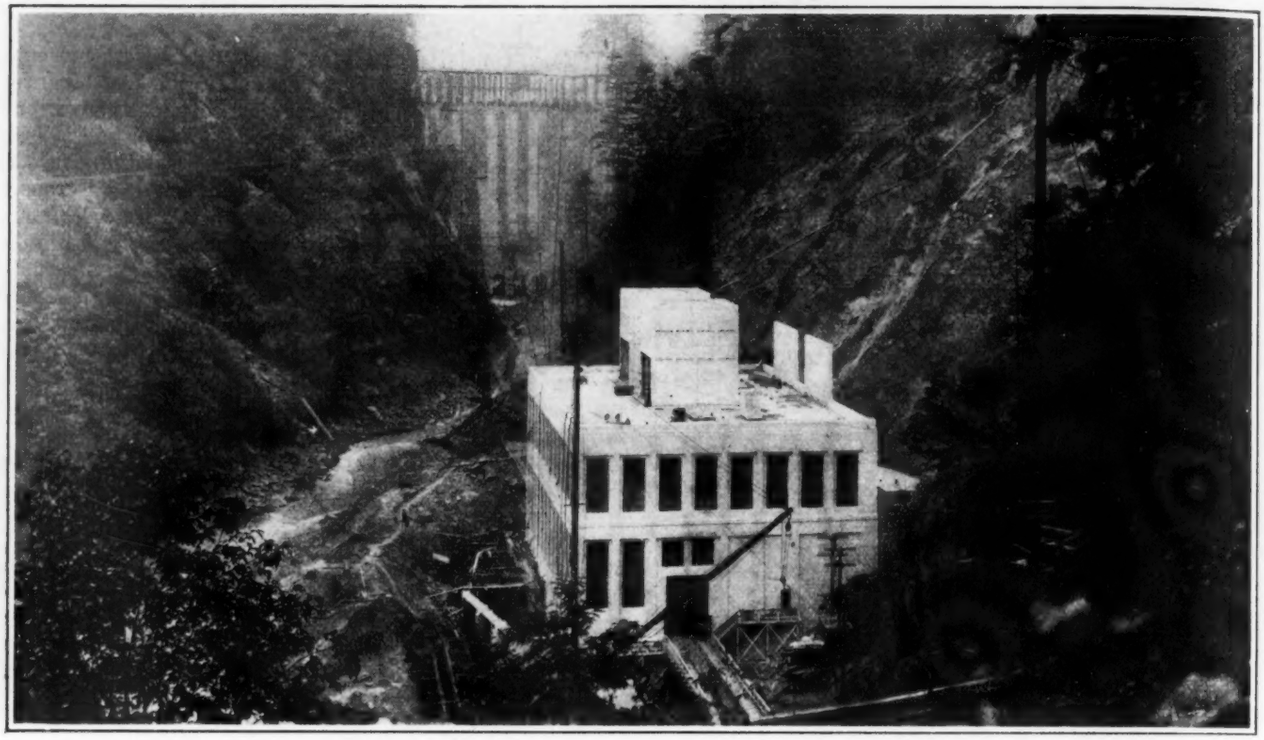
Of course, at the present time such a transmission would necessitate rather a large number of vacuum tubes in parallel; but the idea is quite attractive, and at the rate at which the current rating of hot-cathode rectifiers increases each year such a transmission may be within the range of possibilities not many years hence. There may still be other possibilities for direct-current transmission, but, the prefixes having been nearly exhausted, we suggest that future inventors call their devices the "*a*-verter," the "*b*-verter," the "*c*-verter," etc.

Economic Value of Utility Service to Industry

THE fundamental economies of purchased power over private-plant operation, long stressed by central-station power sales engineers, were brought into sharp relief at the annual meeting of the American Society of Mechanical Engineers in New York last week. Methods of supply and application of industrial power had a prominent place on the program, and much of the discussion by industrial engineers revolved around the fact that unless a manufacturer has extensive need for process steam well balanced in proportion to his power requirements, it is usually far cheaper for him to buy power than to make it. Economic analyses were advocated in all cases.

Aside from the characteristic low load factors at which most private plants must operate, and disregarding other inefficiencies, industrial operators are finding that they can much more profitably invest their money in machinery for manufacturing their products than in a plant for making power upon which they make no profit at all. In a new textile plant, for instance, money placed in looms and other productive weaving equipment is expected to return 25 per cent per year, while money put into a generating plant earns but 6 per cent, which must be figured as part of the power cost and helps add to the total cost of the finished product.

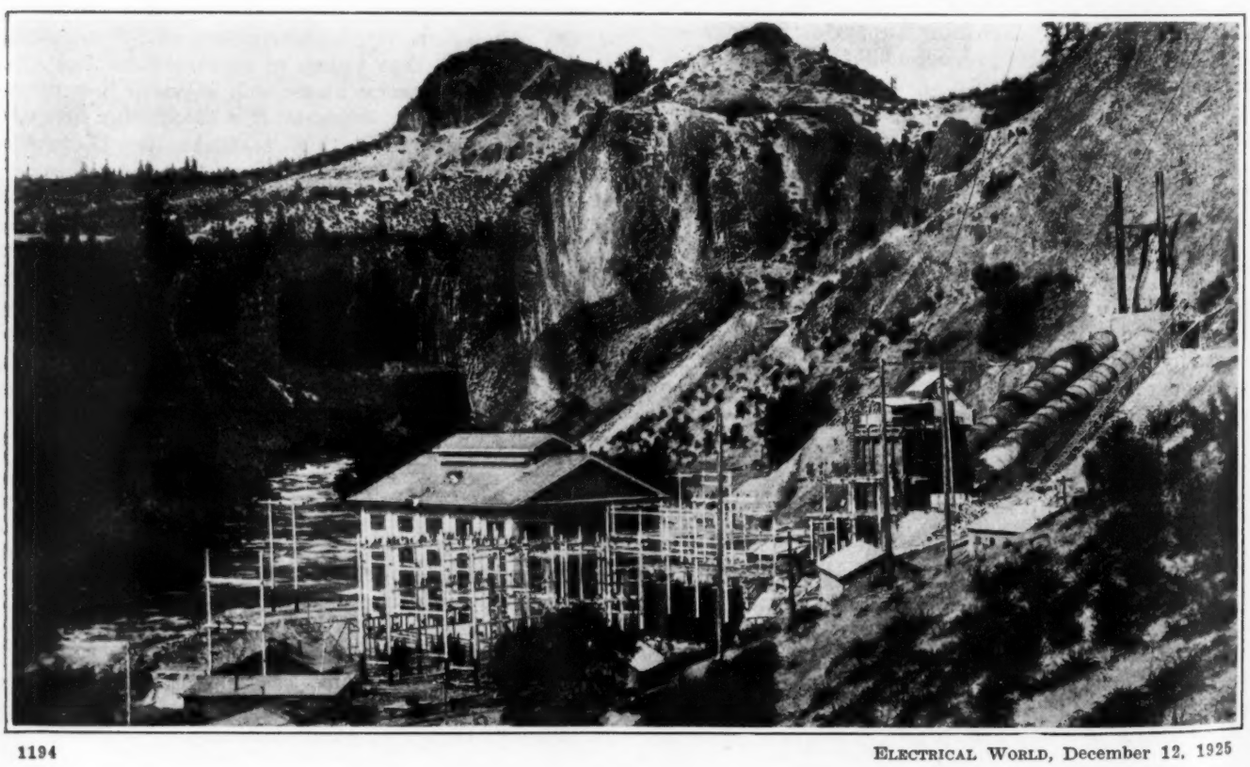
Wherever reliable utility service is available at equitable rates it is preferred over the more expensive, less reliable and obsolescent private plant. The advocacy of such a policy by industrial engineers, who in the past have been possessed of a traditional prejudice against purchased power, is but another manifestation of the value of the power companies' service to industry and an indication of the inherent soundness of the public utility business.



Two New Hydro-Electric Plants in the Northwest

The illustration above shows the progress made on the 40,000-hp. Baker River plant of the Puget Sound Power & Light Company, which was placed in operation in November.

The plant below is Copco No. 2, one of a chain of plants being built by the California-Oregon Power Company on the Klamath River in northern California. Its capacity is 30,000 kva.



Electric Power in the Northwest

A Review of Recent Construction, with Comments on Future Developments, Interconnection, Load Building and Market Possibilities

IN THE Pacific Northwest one finds a territory of unusual hydro-electric possibilities and a land rich in timber, minerals and other natural resources, all as yet practically untouched. The territory is characterized by a number of water-power sites, both large and small, within short transmission distance of the present centers of population. Up to the present time only the smaller of the economical power sites have been developed due to lack of a wider market. The states of Oregon, Washington, Idaho and Montana, at their present rate of growth, demand only about 50,000 kw. of new plant capacity per year, and barring the establishment of some unusually large industries, this development of the smaller power sites will suffice to serve the requirements of the territory for some years to come.

The eight major power companies in this territory showed an increase in kilowatt-hour generation of 14.1 per cent in 1923 and 7.25 per cent in 1924, with a corresponding increase in installed generator capacity of 7.16 per cent and 6.6 per cent respectively. (See Table I.) Since 1922 three major developments have been made as follows: Oak Grove plant of the Portland Electric Power Company, 25,000 kw., completed during the summer of 1924; Mystic Lake development of the Montana Power Company, 12,500 kw., completed in the spring of 1925, and the Copco No. 2 plant of the California Oregon Power Company, 25,000 kw., placed in operation in July, 1925. Besides these, there is the Baker River plant of the Puget Sound Power & Light Company of 31,200 kw. capacity, which was placed in operation during November, 1925.

During the past three years two municipal developments worthy of note have been undertaken, one by Seattle and the other by Tacoma. The Skagit plant of 40,000 kva. capacity of the city of Seattle was completed in the spring of 1925, and Tacoma's 40,000-kva. Cushman plant now under construction is scheduled for completion early in 1926.

The next immediate hydro-electric development to be undertaken in the Northwest will be a 12,000-kw., low-head plant on the Clearwater River, just outside the city of Lewiston, Idaho, to be started during the fall of 1925 by the Pacific Power & Light Company. Part of the output of this plant will be absorbed locally and any surplus will be fed into the eastern Washington and Oregon transmission system of the Pacific Power & Light Company through a 60-kv. line now under construction from Pomeroy, Wash., to Lewiston, Idaho.

Of great importance in the way of hydro-electric developments probably soon to be undertaken in the Northwest is the recent announcement by the Washington Water Power Company of negotiations with the Great Northern Railway, whereby the Washington Water Power Company will develop the Chelan River site at the confluence of that stream with the Columbia River in central Washington. Plans for this development have not been announced by the Washington Water Power Company, but the site is known to be capable of developing about 100,000 hp. The construction of a power plant at this point is said to be linked with future electrification of the Great Northern in eastern Washington. According to D. L. Huntington, president of the Washington Water Power Company, this contract with the Great Northern will mean the postponement of the Kettle Falls project on the Columbia River, which has been under consideration by the Washington Water Power Company for several years.

"A 35,000-hp. or larger hydro-electric development will be started within the next two years on the Deschutes or Lewis River or some other stream convenient to the territory served by the Pacific Power & Light Company and the Northwestern Electric Company, both subsidiaries of the American Power & Light Company," said Guy W. Talbot, president of the two companies.

One of the largest single developments ever to be undertaken in this country will be that at Priest Rapids on the Columbia River. The Washington Power and Irrigation Company has a preliminary permit for the development of this site. Present plans call for the development of 350,000 hp. of primary or all-year power and 150,000 hp. of secondary or flood-water power. Water rights have been secured, all preliminary engineering work has been done, and the money necessary to finance construction is available; the development now hinges only upon establishment of large industries at the site which will absorb the major portion of the primary power. An immense area of irrigable land in the vicinity will absorb the 150,000 hp. of secondary power in irrigation pumping.

The value of water-power sites in this section of

TABLE I—ENERGY PRODUCTION AND PLANT CAPACITY OF EIGHT MAJOR POWER COMPANIES OF THE NORTHWEST FOR 1922, 1923 AND 1924

Company	Kilowatt-Hours Generation* (Total Steam and Hydro)			Plant Capacity in Kilowatts (Total Steam and Hydro)		
	1922	1923	1924	1922	1923	1924
California Oregon Power Company	130,124	152,125	175,778	34,380	35,580	38,780
Portland Electric Power Company	323,645	365,960	393,873	85,630	91,180	115,230
Northwestern Electric Company	118,276	131,266	143,053	30,000	40,000	40,000
Pacific Power & Light Company	59,943	85,645	106,371	23,340	29,040	28,650
Idaho Power Company	192,044	199,673	289,104	47,500	53,500	59,500
Montana Power Company	963,663	1,122,750	1,121,246	212,340	212,340	212,340
Washington Water Power Company	410,149	413,149	432,802	104,870	124,010	124,010
Puget Sound Power & Light Company	474,043	577,578	607,067	127,000	127,000	141,000
Total	2,671,887	3,048,146	3,269,294	665,060	712,650	759,510

* 000 omitted.

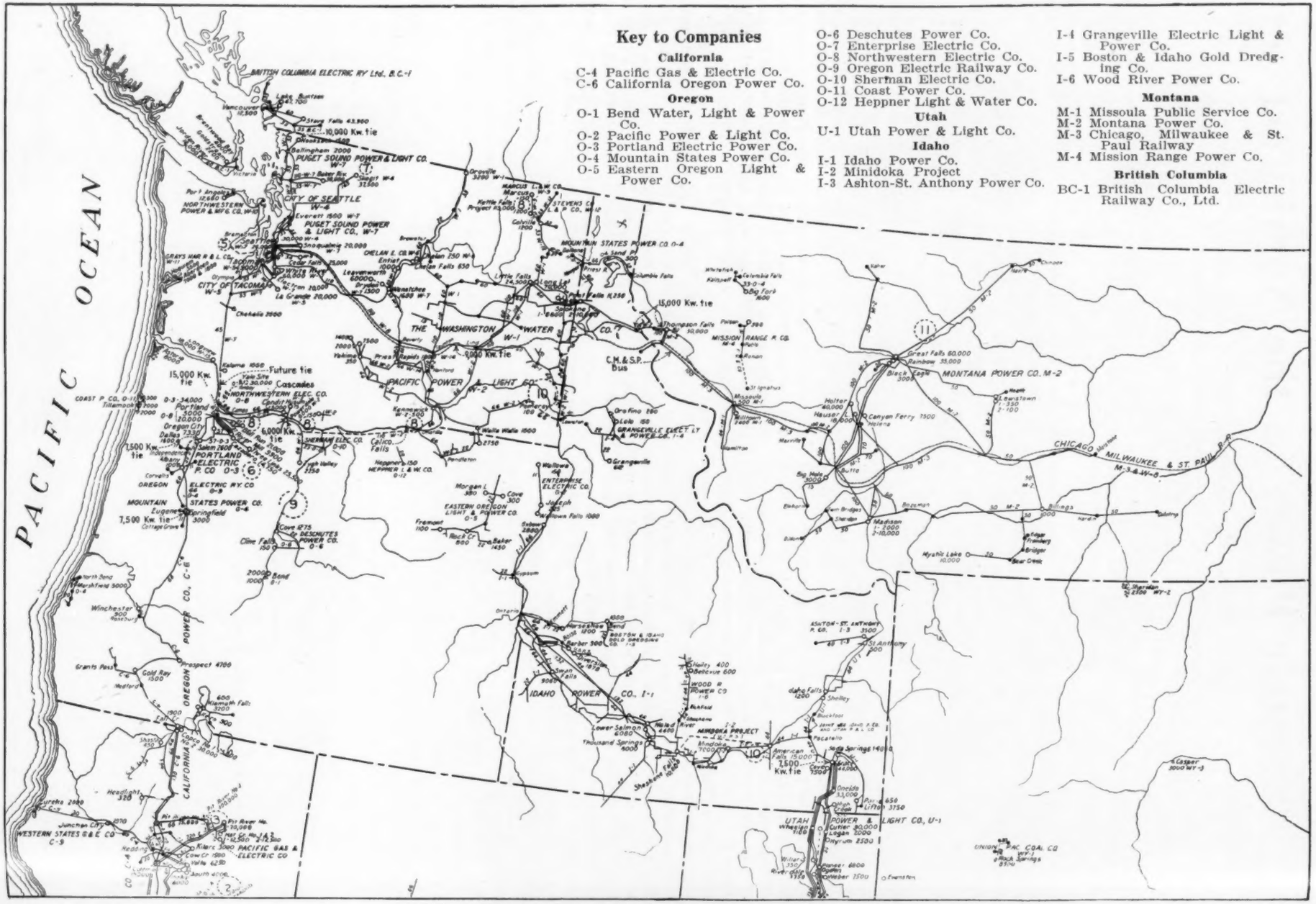
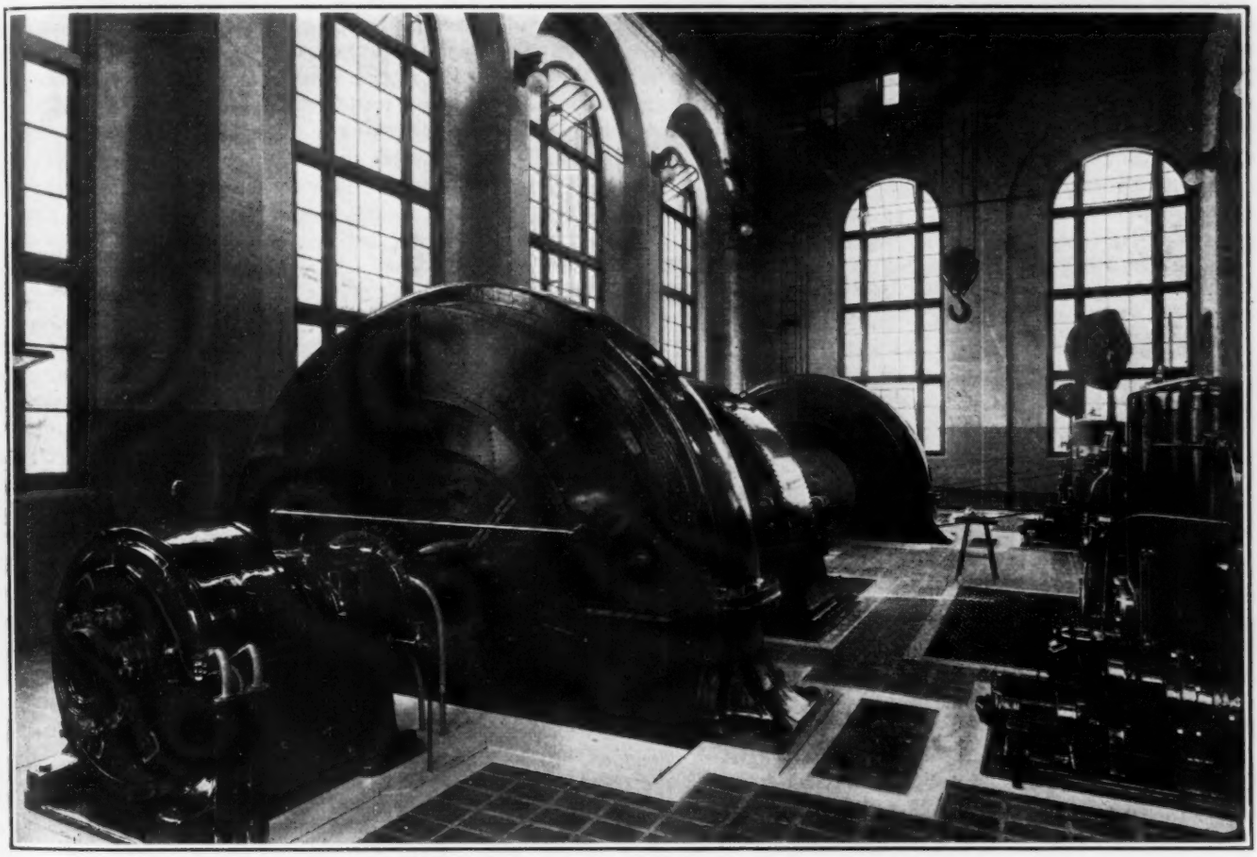

Key to Companies
California
C-4 Pacific Gas & Electric Co.
C-6 California Oregon Power Co.
Oregon
O-1 Bend Water, Light & Power Co.
O-2 Pacific Power & Light Co.
O-3 Portland Electric Power Co.
O-4 Mountain States Power Co.
O-5 Eastern Oregon Light & Power Co.
O-6 Deschutes Power Co.
O-7 Enterprise Electric Co.
O-8 Northwestern Electric Co.
O-9 Oregon Electric Railway Co.
O-10 Sherman Electric Co.
O-11 Coast Power Co.
O-12 Heppner Light & Water Co.
Utah
U-1 Utah Power & Light Co.
Idaho
I-1 Idaho Power Co.
I-2 Minidoka Project
I-3 Ashton-St. Anthony Power Co.
I-4 Grangeville Electric Light & Power Co.
I-5 Boston & Idaho Gold Dredging Co.
I-6 Wood River Power Co.
Montana
M-1 Missoula Public Service Co.
M-2 Montana Power Co.
M-3 Chicago, Milwaukee & St. Paul Railway
M-4 Mission Range Power Co.
British Columbia
BC-1 British Columbia Electric Railway Co., Ltd.
PACIFIC OCEAN
BRITISH COLUMBIA ELECTRIC RY Ltd., B.C.-1
PUGET SOUND POWER & LIGHT CO.
CITY OF SEATTLE W-4
PUGET SOUND POWER & LIGHT CO., W-7
CITY OF TACOMA W-5
THE WASHINGTON WATER POWER CO. W-1
PACIFIC POWER & LIGHT CO. W-2
NORTHWESTERN ELEC. CO. O-8
PORTLAND ELECTRIC P. CO O-3
OREGON ELECTRIC RY. CO. O-9
OREGON MOUNTAIN STATES POWER CO. O-4
CALIFORNIA OREGON POWER CO., C-6
PACIFIC GAS & ELECTRIC CO
WESTERN STATES G & E. CO C-9
MOUNTAIN STATES POWER CO. O-4
EASTERN OREGON LIGHT & POWER CO. O-5
DESCHUTES POWER CO. O-6
ENTERPRISE ELECTRIC CO. O-7
GRANGEVILLE ELECT LT & POWER CO. I-4
BOSTON & IDAHO GOLD DREDGING CO. I-5
IDAHO POWER CO., I-1
WOOD R. POWER CO I-6
MINIDOKA PROJECT I-2
ASHTON-ST. ANTHONY P. CO. I-3
UTAH POWER & LIGHT CO, U-1
MONTANA POWER CO. M-2
MISSION RANGE P. CO. M-4
CHICAGO MILWAUKEE & ST. PAUL R.R. M-3 & W-6
15,000 Kw. tie
6,000 Kw. tie
1,500 Kw. tie
7,500 Kw. tie
Future tie
Cascades
C.M.&S.P. Bus

FIG. 1—INTERCONNECTED TRANSMISSION SYSTEM OF THE NORTHWEST

the country, in common with others, is greatly enhanced by the ability to develop them in stages, as the market for power increases. There is estimated to be 5,000,000 potential horsepower on the Columbia River, but the chief drawback to most of the power sites is the fact that they are not capable of economical development in small blocks. This is true at the Cascades in the Columbia, where there is a quarter of a million potential horsepower; Umatilla Rapids, with approximately 420,000 hp.; Celilo Falls, capable of about half a million horsepower development, and the Priest Rapids site referred to above. This, however, does not hold true of Kettle Falls, previously mentioned. Here the cost of a low diversion dam would not constitute such a large proportion of the total cost of the project, and development of as low as 20,000 hp. could economically be made. The Deschutes River in central Oregon is another important power stream, having about half a million potential horsepower capable of economical development, some of it in large sites and some in small.



MYSTIC LAKE POWER PLANT OF THE MONTANA POWER COMPANY

There are, however, a great many water-power sites left in the Northwest which, even though developed to their ultimate, would mean only about 20,000 hp. each. Such sites will logically be developed first in the future to supply the normal growth of load in the territory and only the establishment of some very large industries with large power requirements, such as electrochemical or metallurgical plants, will warrant the development of some of the larger sites referred to above.

Interconnection as it exists at present in the Northwest is advantageous largely for supplying emergency or breakdown service to adjacent properties, was the opinion of central-station executives. All of the large power systems of the Northwest are at present tied in with other near-by systems, either for the purpose of interchanging power or for emergency service. The maximum capacity of any one of these ties is limited to about 15,000 kw., and with the further limiting factor of long transmission lines, which have a tendency to become unstable, it is difficult to hold the systems in step. There are, however, several interconnecting lines that are used for the continuous transfer of power from one company to another, such, for instance, as between the California Oregon Power Company and the Mountain States Power Company; the Pacific Power & Light Company and the Northwestern Electric Company; the Idaho Power Company and the Utah Power & Light Company; the Montana Power Company and the Washington Water Power Company; the Washington Water Power Company and the Pacific Power & Light Company; the Washington Water Power Company and the Puget Sound Power & Light Company, and the Western Power Company of Canada and the Puget Sound Power & Light Company. The points of interconnection between these systems and the capacity of tie lines is shown in Fig. 1.

The Mountain States Power Company has under construction an 18-mile, 60-kv. line between Independence and Salem, Ore., which will tie in the Mountain States Power Company and the Portland Electric Power Company, adding another section to the Pacific Coast interconnected system as shown in Fig. 1. The line will give the Mountain States Power Company, which now purchases a large part of its energy from the California Oregon Power Company, an emergency connection of 7,500 kw. capacity with another large generating system. There is also now under construction a 66-kv., 15,000-kw. line between the Northwestern

FIG. 1—INTERCONNECTED TRANSMISSION SYSTEM OF THE NORTHWEST

Electric Company and the Portland Electric Power Company in the city of Portland, which will enable these companies to exchange excess power and render each other assistance in cases of emergency.

In discussing the relation of interconnection to power developments, Franklin T. Griffith, president of the Portland Electric Power Company, said: "It is economy for power companies in any given district to interconnect and work together on hydro-electric developments. A new plant is usually all surplus when first completed and several users can absorb the output much faster than can one company." The number and size of intersystem ties are constantly increasing and the day is not far distant when utilities of this section will be able to co-operate in power developments, was the opinion of Guy W. Talbot, president of the Pacific Power & Light Company. "With the diversity in water supply between the territory lying west of the Cascade Range and that lying to the east, there is an excellent opportunity to utilize interconnection and take full advantage of this diversity of stream flow," he declared. His company has plans for building a 90-mile, 66-kv. line from Pendleton to The Dalles, Ore., which will tie the two portions of the Pacific Power & Light Company's system together (see Fig. 1), thus closing the last gap in the interconnected system on the Pacific Coast from Mexico to eastern Montana.

"It is likely," said A. W. Leonard, president of the Puget Sound Power & Light Company, "that our transmission lines to the south will soon connect with those of the Northwestern Electric Company, thus closing the gap in the Coast interconnected system at another point. We have just completed a 60-kv. line between our new substation at Sedro Woolley and Bellingham, Wash., which will enable us to supply our Bellingham system from our Baker River plant, which is now nearing completion. Bellingham has heretofore been isolated from our major system to the south and we have been purchasing practically all the requirements for this territory from the Western Power Company of Canada, a subsidiary of the British Columbia Electric Railway Company."

In so far as Montana is concerned interconnection will not soon influence power development, because of the great distances involved and the low cost and selling price of power, was the feeling expressed by F. M. Kerr, vice-president and general manager of the Montana Power Company. "The economic limit of transmission is where the interest on the first cost just equals the value of lost power," he said, "and where our interconnecting lines would of necessity be so long, we are limited in the lengths to which we may go to interconnect with adjacent power systems."

Although the Pacific Northwest is largely an agricultural territory, there are nevertheless several important basic industries, chief among which are lumbering, mining, shipping and fishing. Central stations in this region still have to pioneer to a considerable extent in developing new load, and it is perhaps because of this situation that the electric range load had reached such proportions in this territory.

The electric range business had its inception back in 1914, when H. J. Gille of the Puget Sound Power & Light Company; W. R. Putnam, at that time with the Utah Power & Light Company; A. C. McMichen of the Portland Electric Power Company and L. A. Lewis of the Washington Water Power Company foresaw the possibilities of increasing residential consumption through the medium of the electric range. From that time on the electric range business has grown until on Sept. 1, 1925, there were 40,349 electric ranges served by the eight major systems in Oregon, Washington, Idaho and Montana.

The sale of ranges and the saturation for the past three years on these systems are shown in Table II. By the close of 1925 the Puget Sound Power & Light Company will have in the neighborhood of 12,000 ranges connected to its lines, the largest number of ranges served by any individual central station in the United States. Of this number approximately 6,000, or nearly half, will have been installed during 1925, demonstrating beyond a doubt that the housewife is sold on the advantages of electric cooking and that there is no longer any great sales resistance to overcome in selling the electric range.

TABLE II—ELECTRIC RANGES SERVED AND SATURATION FOR EIGHT CENTRAL STATIONS IN OREGON, WASHINGTON, IDAHO AND MONTANA

Company	Ranges Served			Saturation in per Cent—i.e., Number Ranges per Residential Customer		
	1922	1923	1924	1922	1923	1924
California Oregon Power Company	1,206	1,456	1,729	14	14	15.5
Portland Electric Power Company	1,725	3,501	5,357	3.1	5.7	7.9
Northwestern Electric Company	695	1,171	1,858	5.7	8.9	13.3
Pacific Power & Light Company	895	1,366	1,528	3.4	3.9	4.3
Idaho Power Company	4,353	4,786	5,273	20.0	21.6	24.0
Montana Power Company	3,162	3,840	4,330	10.0	12.0	13.0
Washington Water Power Company	3,935	4,983	5,944	12.2	15.5	18.0
Puget Sound Power & Light Company	1,800	3,000	6,000	3.0	3.7	6.6
Total	17,771	24,103	32,019	Average.. 8.92	10.65	12.82

Water heating, too, offers great possibilities for increasing residential consumption. There are now approximately half as many water heaters in use in the Northwest as there are electric ranges, and a strong effort is being made to sell a water heater with each electric range that is installed. Some of the companies made the mistake at first of taking on water heating at too low a flat rate and are now experiencing difficulty in changing over to a metered basis or increasing the amount of the flat rate charge. H. J. Gille, general sales manager of the Puget Sound Power & Light Company, feels that water heating offers an exceptional opportunity for the central station to increase its revenue, and his company is building a very satisfactory load of this type by an aggressive selling policy.

Of the eight central stations interviewed in connection with this article all but one, the California Oregon Power Company, are merchandising electrical appliances. Executives and commercial men feel that appliance selling is the surest way to increase the revenue from residential customers. "Increased use of appliances of all kinds, coupled with the electric range, has been responsible for increasing our consumption per residential customer from an average of 20 kw.-hr. per month in 1917 to 42 kw.-hr. per month in 1925,"

said President Griffith of the Portland Electric Power Company. Other companies in the Northwest have shown a similar increase.

Executives of all companies were unanimous in the opinion that the greatest problem before the industry is the development of load on existing distribution facilities, rather than expansion into unprofitable territory. Working along these lines, all companies are actively pushing ranges, water heaters, small room heaters, washing machines, electric ironers and the smaller appliances.

The Pacific Power & Light Company has just finished a range campaign and is going to put on additional salesmen and launch an intensive drive on all kinds of appliances to dispose of surplus power that will soon be available from its Clearwater development at Lewiston, Idaho, above mentioned.

Merchandising sales per residential customer on the system of the Idaho Power Company just about equal the annual revenue per residential customer, and sales so far during 1925 have shown an increase of 60 per cent over 1924. Domestic electric refrigeration sales during 1925 have shown a large increase for all companies over 1924, and 1926 will see all large central stations in this territory actively pushing the domestic refrigerator, either by direct sales or by assisting other agencies. Greater progress has been made by the Washington Water Power Company than by any other central station in the Northwest in the sale of domestic electric refrigerators thus far. L. A. Lewis, sales manager of that company, feels that for the next few years the power company should be willing to spend all the revenue it derives from this class of business in further developing it and that the central station should be willing to work with the manufacturers to the extent of eliminating trouble and do it with the same cheerfulness as they have done with other devices which required pioneering.

Rural Electrification

Service is being extended into rural communities by all utilities just as rapidly as extensions can possibly be justified. The State of Washington has done more along these lines than any of the other states in the Northwest, now having 27,000 rural customers. It is interesting to note that the State of Washington, with only about one-third the population of the Province of Ontario, has approximately twice the number of rural customers. Rural towns and communities on the system of the Washington Water Power Company show a range saturation of 33⅓ per cent, and individual towns on this and other systems show saturations as high as 50 per cent, indicating the possibilities of the electric range for making rural extensions more profitable.

In the opinion of A. S. Moody, Northwest district manager of the General Electric Company, rural electrification is solved where there is irrigation pumping to take care of the fixed charges on the investment to serve. He pointed out that although much of the farming in the Northwest is dry farming, it has been found recently that berries, fruit and even pasture lands in sections of heavy rainfall may be advantageously irrigated during the summer. Further development along these lines, he feels, may warrant extension of lines into territory heretofore unable to secure service.

There are many farming sections in the Northwest, notably in Idaho, where farmers have spent a thousand dollars for electrical appliances in their homes. Such installations consist of an electric range, a water heater, an electric refrigerator, a washing machine, an electric ironer and the smaller table appliances. The encouraging part of this is that there is not merely one farm so equipped, but a great many.

The lumber industry offers the largest single industrial market for the larger power companies in Oregon and Washington, and because of the growing importance of the lumber industry in this section it constitutes one of the important markets for increased energy sales. Practically all of the large mills are now either partly or wholly electrified and two major logging operations in Washington are carried on with electric yarders and loaders. In many cases sawmill and logging operations are so far removed from central-station service that it has been found more economical for the mill to generate its own power, using mill refuse or so-called hog fuel for firing the boilers. Where cheap transportation is available, the mills have found it more economical and satisfactory to sell their mill refuse and purchase energy for operation of the mill from the local power company. This is the situation around Portland, where about 50 per cent of the available mill refuse is being utilized by the Northwestern Electric Company and the Portland Electric Power Company in their steam plants.

The pulp and paper industry is destined to play an important part in the future development of the Northwest, because of the fact that a large part of the remaining available pulp wood supply on the North American continent is located in Oregon, Washington and British Columbia. There are already important paper-manufacturing plants at Oregon City, Ore.; Salem, Ore.; Camas, Wash.; Port Angeles, Wash.; Spokane, Wash.; Powell River, B. C., and Ocean Falls, B. C. All of these mills are producing newsprint or wrapping paper, but it is likely that they will add facilities for the production of book paper and other high-grade stock or that other mills will be established within a few years for this purpose. "The pulp and paper industry must logically come to the Northwest," said one executive, "but developments along these lines will probably take the form of expansion of existing mills rather than establishment of many new plants."

Railway Electrification

New interest in railway electrification has been created in the Northwest by the announcement of the Great Northern Railway that it will make about a 30-mile extension to its present tunnel electrification in the Cascade Mountains in western Washington. The Westinghouse Electric & Manufacturing Company has been awarded a contract for furnishing four locomotives and for making the complete installation, including trolley and substations, and expects to have its work completed by the middle of 1926.

It seems feasible, in view of the present action of the Great Northern, that its next step will be complete electrification from Everett, Wash., to Spokane, Wash., a distance of 305 miles.

Plans of the Milwaukee road for electrification on the 220-mile engine diversion from Avery, Idaho, to Othello, Wash., were halted by the receivership of the road early in 1925. One of the reorganization plans proposed, however, contemplates the electrification of this section and it seems likely that the next few years will see this remaining gap closed, giving the Milwaukee complete electric operation from Seattle and Tacoma to Harlowton, Mont., on the east slope of the Rocky Mountains, a distance of 854 miles.

Economic Spacing and Size of Substation

Effect of Substations on Primary Distribution Costs—Evaluation of Losses and Costs to Secure Minimum Over-all Costs—Use of General Standard Advocated

By EVERETT L. SWEET
The Philadelphia Electric Company

WITH the constantly increasing loads that the electric utilities must generate, transmit and distribute, economical distribution design becomes more and more important. The most economical design consistent with good service conditions results in a maximum return for each dollar invested in the plant. In this article is presented a study of the economic size of substations for characteristic portions of a system in a metropolitan area, in which there is aërial distribution. The results are, of course, directly applicable only to systems where similar conditions prevail, but the method used is generally applicable, and the results show very definitely the relative magnitude of the elements involved in the study of distribution systems. The economic spacing and size of substations involves a proper balance between two classes of costs, substation and transmission cost on the one hand, and primary feeder cost on the other. A decrease in substation rating will be accompanied by a reduction in the mileage and therefore the cost of primary feeders and by an increase in the per kilovolt-ampere cost of substations and their operation. The problem is mainly one of distribution and the results show how far it is practical to go, with the art in its present state, in decreasing the number of substations in order to effect savings in primary circuits.

Since the size of substations affects not only their own cost but that of transmission and distribution as well, a brief description of these parts follows: Transmission is almost entirely underground by means of three-conductor, 350,000-circ.mil cables operating at the generated voltage, 13,200 volts, three phase, 60 cycles. The substations step down this voltage to 2,300 volts, two phase, three wire by means of Scott-connected transformers. The primary distribution circuits are two phase, three wire, 2,300 volts between each phase wire and the common return. The distribution transformers are of the standard 2,300-230/115-volt type. Single-

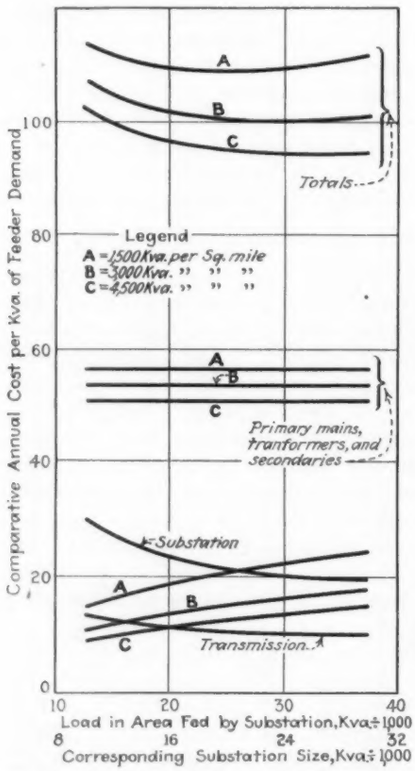


FIG. 1—COMPARATIVE COST OF TRANSMISSION, SUBSTATIONS AND DISTRIBUTION FOR VARIOUS SUBSTATION SIZES

Two-phase, three-wire, 2,300-volt primary circuits. Single and two-phase secondaries.

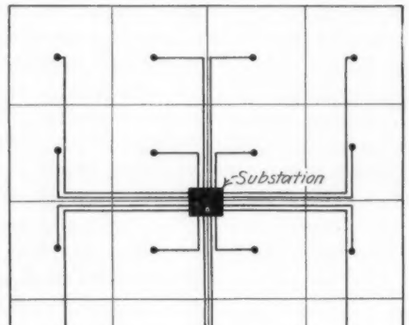


FIG. 2—AN ASSUMED SYSTEM FOR A SUBSTATION AND FEEDER LAYOUTS

Total load in area 13,800 kva.; area of section 9.2 square miles; average length of feeder, 8,000 ft.; number of circuits, 16.

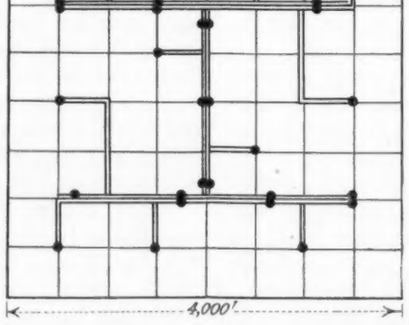


FIG. 3 — PRIMARY MAINS AND TRANSFORMERS FOR ONE OF THE "SQUARES" OF FIG. 2

Demand per circuit, 863 kva.; transformer capacity per circuit, 1,175 kva.

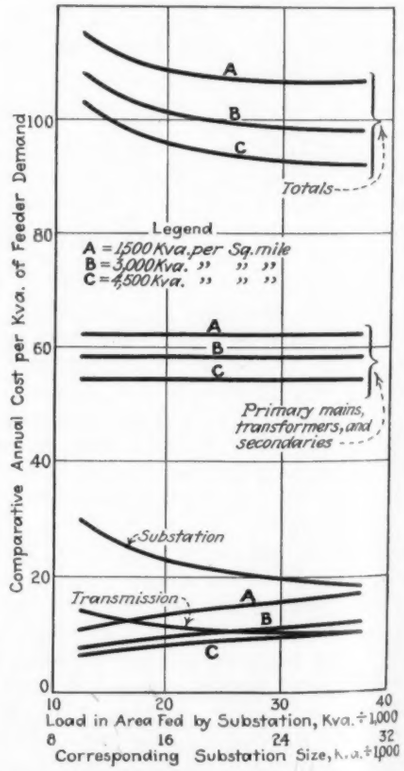
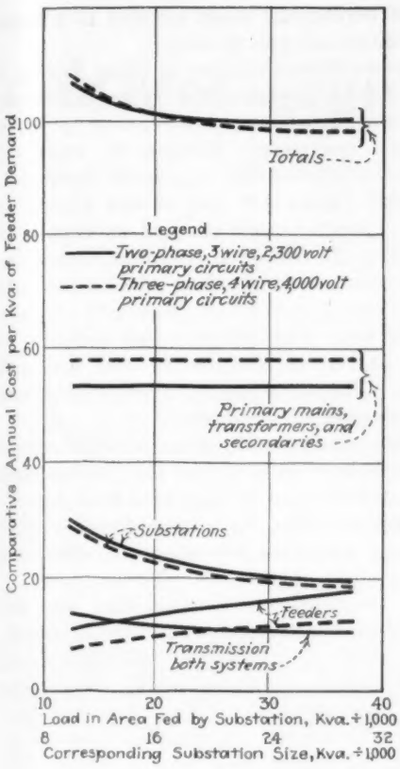


FIG. 4—COMPARATIVE COST OF TRANSMISSION, SUBSTATION AND DISTRIBUTION FOR VARIOUS SUBSTATION SIZES

Three-phase, four-wire, 4,000-volt primary circuit. Single and two-phase secondaries.

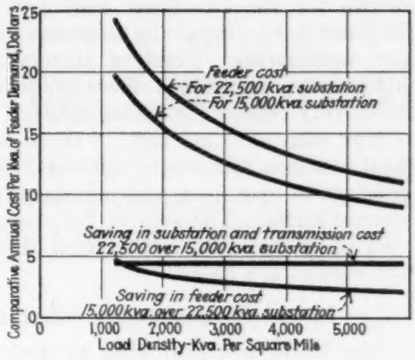

Totals
Legend
Two-phase, 3 wire, 2,300 volt primary circuits
Three-phase, 4 wire, 4,000 volt primary circuits
Primary mains, transformers, and secondaries
Substations
Feeders
Transmission both systems
Comparative Annual Cost per Kva. of Feeder Demand
Load in Area Fed by Substation, Kva. ÷ 1,000
Corresponding Substation Size, Kva. ÷ 1,000

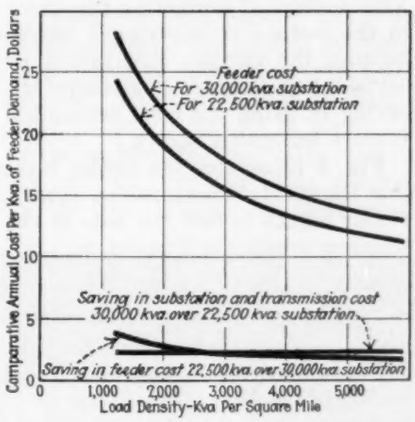
COST COMPARISONS FOR DIFFERENT DISTRIBUTION SYSTEMS AND SUBSTATION SIZES

Fig. 5 (left)—Comparative annual cost of transmission, substation and distribution. Solid line for two-phase, three-wire, 2,300-volt primary circuits. Dotted line for three-phase, four-wire, 4,000-volt primary circuits. Polyphase secondaries (two-phase) for both systems. Load density 3,000 kva. per square mile.

Fig. 6 (upper right)—Comparative annual costs of 15,000-kva. and 22,500-kva. substations. Transmission, substation and feeder costs. Two-phase, three-wire, 2,300-volt distribution.

Fig. 7 (lower right)—Comparative annual costs of 22,500-kva. and 30,000-kva. substations. Transmission substation and feeder costs. Two-phase, three-wire, 2,300-volt distribution.


Feeder cost
For 22,500 kva. substation
For 15,000 kva. substation
Saving in substation and transmission cost 22,500 over 15,000 kva. substation
Saving in feeder cost 15,000 kva. over 22,500 kva. substation
Comparative Annual Cost Per Kva. of Feeder Demand, Dollars
Load Density-Kva. Per Square Mile


Feeder cost
For 30,000 kva. substation
For 22,500 kva. substation
Saving in substation and transmission cost 30,000 kva. over 22,500 kva. substation
Saving in feeder cost 22,500 kva. over 30,000 kva. substation
Comparative Annual Cost Per Kva. of Feeder Demand, Dollars
Load Density-Kva. Per Square Mile

phase secondaries are three wire, 115/230 volts and polyphase secondaries are five wire, 115/230 volts.

The results of the two-phase, three-wire, 2,300-volt system are shown by means of the curves, Fig. 1. The curves designated "totals" show the comparative total annual cost of transmission, substations and distribution for various substation sizes and for three load densities, 1,500, 3,000 and 4,500 kilovolt-amperes per square mile, the kilovolt-amperes being taken as the sum of the non-coincident yearly peak demands on primary feeders. The 1,500 kva. per square mile load density is representative of the better class residential districts in outlying sections, 3,000 kva. per square mile of the more central residential districts, and 4,500 kva. per square mile of the sections containing stores and small manufacturing establishments.

For purposes of comparison, the ordinates of the curves, Fig. 1, are shown in per cent, the minimum cost for the 3,000-kva. load density being taken as 100 per cent. The curves show that the economic substation sizes or the points at which the cost per kilovolt-ampere is a minimum are as follows:

Load Density	Most Economical Substation Kva.
1,500	20,000
3,000	24,000
4,500	28,000

It is a fortunate fact that the curves are "flat" over a considerable range of substation sizes, hence deviations one way or the other from the exact economic size do not result in a large increase in cost.

EXPLANATION OF CURVES

For the purpose of this analysis a distinction is made between primary feeders and primary mains. A primary feeder may be defined as the part of the primary circuit between the substation and the center of load on the circuit. The primary mains are the branches that lead off the feeder. (See Figs. 2 and 3.) The cost per kilovolt-ampere of primary mains, transformers and secondaries is constant for any given load density, but, of course, decreases as the load density increases.

The cost per kilovolt-ampere of substations decreases as the size increases. It is necessary to have one spare transformer bank in each substation in order to insure continuity of service in the event of a transformer failure. As the size of substation increases, the percentage of spare capacity decreases, with a resulting lower cost per kilovolt-ampere. For a similar reason, the cost of transmission decreases with increasing substation sizes, because it is necessary to run a spare cable to each substation.

The cost per kilovolt-ampere of feeders increases as the substation size increases, because for a given load density the area which a substation feeds is determined by the substation size, a larger substation therefore involves a longer average "haul" for the feeders.

METHOD USED

The first step in this analysis consists in laying out an assumed system as shown in Fig. 3. This system, though artificial in the sense that it does not actually exist, is representative of existing conditions. Thus the length of primary mains per circuit, the proportion of three-wire and two-wire primary mains, the number and size of transformers, transformer capacity per circuit, etc., are approximately the averages for the actual system. This method of analysis is a practical one, because it takes into account all the major conditions of distribution practice and local variations of load density.

Fig. 3 is representative of the load density of 1,500 kva. per square mile. Similar diagrams have been

drawn for the two other load densities, although not included here. Separate diagrams have been drawn for the secondaries. Straight streets and 500-ft. square blocks are assumed in these layouts, a condition that holds very closely for Philadelphia.

For each of these layouts there is computed the annual charges, comprising interest, insurance, taxes, depreciation, operation and maintenance, and the cost of energy losses. The sum of the annual charges and the cost of energy loss is the total annual cost, on which the results are based.

LOSSES EVALUATED AT "COAL PILE" VALUE

The losses are evaluated at their "coal pile" value. This method of evaluating the losses is used in contrast to the method of applying a demand cost in addition, because the savings ascertained by its use are more certain and tangible, and therefore the true "dollars" saving in using the most economical size of substation is more accurately shown.

Fig. 2 illustrates the feeder layouts. It is assumed that the substation supplies a square area. The average feeder length is half the side of the square. The area which a substation supplies is:

$$\text{Area supplied by substation} = \text{Substation Size} \times 1.25 \div \text{Load Density}$$

The diversity between primary feeders is 1.25. The substation size is taken as the total installed transformer capacity less the capacity of one bank, which is held as a spare. The diversity factor must be included, because the load density is based on feeder demand.

The average length of feeder is then:

$$\text{Average length of feeder} = \tfrac{1}{2}\sqrt{\frac{\text{Substation Size} \times 1.25}{\text{Load Density}}}$$

and the average feeder cost per kilovolt-ampere:

$$\text{Average cost per kilovolt-ampere of feeders} = K\sqrt{\frac{\text{Substation Size} \times 1.25}{\text{Load Density}}}$$

It makes no difference whether calculations are based on the total feeder mileage in the area fed by the substation or on the average feeder length, because the result is the same when reduced to a cost per kilovolt-ampere.

The substation costs are based on estimates for substations of four sizes, 10,000, 15,000, 22,500 and 30,000 kva. The substation costs are divided by 1.25, the diversity between feeders, to reduce them to the same basis as that used for the primary feeders and mains, transformers and secondaries.

COMPLETE SYSTEM COSTS INCLUDED

Because the cost per kilovolt-ampere primary mains, transformers and secondaries is constant regardless of the substation size, this item could have been omitted from the curves shown in Fig. 1 without affecting the economic size of substations. The reason for its inclusion is to give the complete picture. It should be noted, however, that the variable quantities are the primary feeder cost on the one hand and substation and transmission cost on the other, the former cost increasing with increasing substation sizes and the latter cost decreasing.

Although the curves show only a small percentage difference in cost as between using one substation size or another, a small percentage when applied to a large system involves a large amount of money.

In Fig. 4 are shown curves similar to those in Fig. 3 but for a system with three-phase, four-wire, 4,000-volt primary circuits and two-phase secondaries in cases where a polyphase secondary voltage is required. Transformation is, of course, by means of Scott-connected transformers. Data for the curves shown in Fig. 4 are obtained by the same method as that used for the curves in Fig. 3. Because the secondaries are the same in either case, a comparison of the two sets of curves gives a comparison between these two primary systems of distribution. The 100 per cent ordinate in Fig. 4 represents the same cost as the 100 per cent ordinate in Fig. 3. The percentage values of the two sets of curves are therefore comparable.

In Fig. 5 there are shown on the same plot the curves for the two-phase-two-wire system and the three-phase-two-phase system. All the curves are for a load density of 3,000 kva. per square mile, the curves for the other load densities being excluded in order to eliminate confusion.

In view of the constantly increasing load and the uncertainty of future developments, it would obviously be impractical to build a variety of different sized substations, each designed for its particular area. The problem is rather that of selecting a substation size that can be adopted as a general standard and yet be the most economical for average conditions. Standardization of substations as well as of most other items of equipment means more rapid construction and less confusion, with the consequent effect upon cost. The advantages of standardization are well recognized in the electrical industry.

COMPARISON FOR VARIOUS LOAD DENSITIES

Figs. 6 and 7 give a comparison between specific substation sizes for various load densities. In these curves are included only those costs which are affected by the size and spacing of substations, namely: substation and transmission cost on the one hand, and primary feeder cost on the other. There is a saving in substation and transmission cost which is constant for any load density and in favor of the larger substation size, while there is a saving in feeder cost in favor of the smaller size. For the load density at which these two cost increments are equal one substation size is just as desirable economically as the other. For lower load densities the smaller size is more economical, and for higher load densities the larger size gives the lower cost for the substations necessary.

In Fig. 6 the saving in favor of the 22,500-kva. substation is very marked for load densities above 1,500 kva. per square mile. But in Fig. 7 the difference between the 22,500-kva. and the 30,000-kva. sizes is comparatively small. The ordinates of these curves are on the same basis as those in Fig. 1.

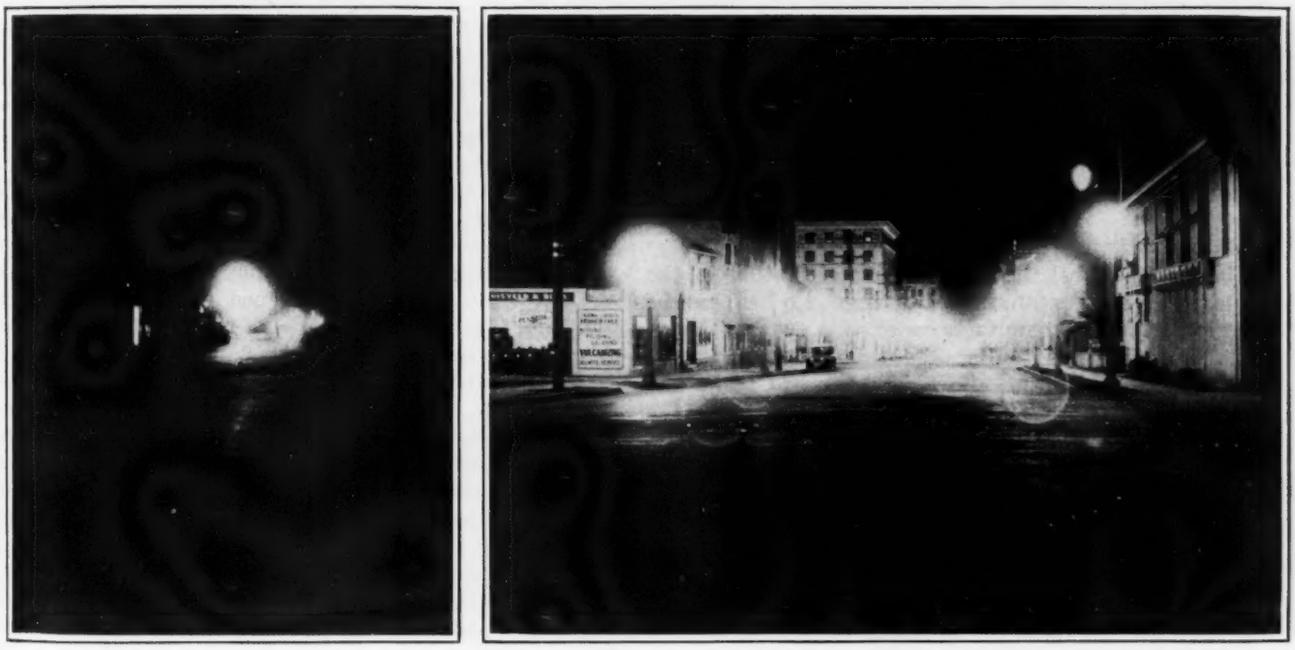
Having selected a size of substation that is most economical as a general standard, there are other factors that must be considered in each particular case of the installation of a new substation. A thorough study of such factors as the load center of the area to be fed, existing duct lines, cost of land, relation to other substations, etc., is important in selecting a site for a particular substation. It is, however, not within the scope of this article to discuss these factors, which are so largely influenced by local conditions.

Street Lighting from Utility Viewpoint

Benefits from Lighting Must Be the Prime Factor — A General Scheme Should Be Adopted—The Central Station Must Stand Between the Manufacturer and Community

By G. H. P. DELLMANN
Lighting Sales Engineer San Diego Consolidated Gas & Electric Company, San Diego, Cal.

NEVER in the history of the light and power industry has street lighting been given the thought and consideration by central stations that it deserves. This is true even at the present time, when more progress has been made during the past two years than in the preceding decade. Revenue produced from street lighting may seem insignificant as compared with other sources of revenue, but it should be realized that the revenue from general lighting is proportional to that from street lighting. If the standard of street lighting be raised, the standard of general illumination will also be raised.



NIGHT VIEWS OF A BUSINESS STREET IN SAN DIEGO, CAL., BEFORE AND AFTER NEW STREET LIGHTING WAS INSTALLED
Contrast the dark street on the left with the well-lighted street on the right under the new system

Unfortunately, however, many public utilities do not seem to appreciate the full value of good street illumination to themselves or to the community they serve. In consequence most communities of the country are inadequately lighted, from the standpoint of both safety and convenience. Seldom is a general plan outlined, much less followed.

Never has so much ornamental lighting been done as in the last few years. This is due largely to the activities of the manufacturers of street-lighting equipment. Street-lighting activities of a community need the intelligent guidance and co-operation of the central station so that there will be some uniformity and proper co-ordination in the general plan. As a rule the central station is best equipped to furnish the specialized talent necessary in such matters, and it owes this service to the community. The central station has even more than a community interest in the type of street lighting installed. It is called upon to maintain the system for years after it is placed in service.

It is not the intention here to convey the idea that the central station has all the knowledge on street lighting and therefore sits in judgment upon what is good or bad practice. On the contrary, it is the manufacturer of street-lighting equipment who has taught us what we know of the art. It is by the proper use of this knowledge together with an unbiased viewpoint and the ability to foresee future developments that we can be of the greatest service to the community and also to those to whom we are indebted for this knowledge.

Promotion Work Necessary

Much of the improvement in street lighting depends upon a certain amount of promotion work with its incidental expense, which cannot and should not be borne by the central station for obvious reasons. It is therefore logically done by the manufacturer of the equipment. Unfortunately the manufacturer of ornamental street-lighting equipment is more often interested in selling lighting standards than he is in the resultant illumination. Matters of spacing, mounting height,

types of glassware, lumens per unit, etc., are all of secondary consideration.

Beautiful lighting standards are often installed and the entire purpose of the installation is defeated by mounting inferior glassware giving insufficient illumination in order to save 10 per cent on the cost of the installation. The use of glassware with a high absorption factor because it fills the glass beautifully with light is also one of the infractions of good practice indulged in. Ornamentation and price should receive their proper consideration, but utility should be the prime factor. It is therefore up to the central station to see that the most efficient use of the energy supplied is made, commensurate of course with the type of lighting used. The central station is not doing its full duty to the community when it permits, or at least does not advise against, anything less. The fact that many communities are using obsolete ornamental lighting standards, which from a revenue-producing standpoint are just as good as the modern type of luminaire furnishing from five to six times as much effective light, is no reason why the central station should not be the champion of better street lighting. Even if such lighting were just as good, is the central station doing its share in the upbuilding of the community when it permits this condition to exist and sits quietly by? But it is not "just as good," for when the illumination on the street is increased, show-window and all store lighting will also be increased, with a resultant increase in revenue.

NON-ORNAMENTAL LIGHTING FAVORED

The greatest task before the central station is the sale of non-ornamental street lighting. No help can be expected from the manufacturer of this type of equipment, because the results obtained by him are not commensurate with the effort necessary to make the sale, so it is up to the central station to promote the proper kind of street lighting. It must be recognized, however, that ornamental lighting in districts where it is warranted will automatically increase the purely utilitarian type to a marked degree.

Selling more and better street lighting has been the problem before every street-lighting group or committee for years, and the author does not profess to have the one and only idea for bringing about the desired result, but it is certain that it is possible to educate every community to demand a higher standard of lighting and a more extensive lighting of its streets.

The passage of certain legislative acts allowing the construction costs to be spread over a period of years and permitting maintenance costs to be added to tax bills is one of the possible solutions. Why do people complain of taxes? Is it because they are really a burden, or is it because they do not understand for what purpose the money raised through taxation is spent? Most households spend two or three times as much for gas and electricity as they do for the service rendered by the municipality, and yet do not complain. The difference is that in the one case they see what they are getting for their money and in the other they do not. City authorities do not take the trouble to analyze the budget for the benefit of the taxpayer. Street-lighting appropriation, however, is an item that can easily be explained and justified, and it is the duty of the light and power industry to see that the public demands street-lighting appropriations consistent with the needs of the community.

It is seldom that there is a real champion of street lighting in the city government as there is for the fire department, police department, water department and the city engineer's office. Street-lighting matters are usually under the jurisdiction of a civil engineer or a mechanical engineer or the city electrician, who professes no knowledge of street-lighting matters, but looks upon it as one of his painful duties. It therefore resolves itself into a job for the central station, and this can be made a privilege that will result in mutual advantage. If an educational program is carried out in such a manner that it will not be misconstrued, it will be welcomed not only by the authorities but by the community at large.

RAISING THE MINIMUM STANDARD

The street-lighting committee of the Pacific Coast Electrical Association in its report last year recommended against the use of less than 2,500-lumen lamps for street lighting. It took a lot of courage to make such a recommendation, but the writer, firmly believing this to be good practice, started a campaign among some of the communities in San Diego County, California, to bring their minimum up to this standard. A talk was given before the county league of municipalities, at which every community in the county was represented, and this was followed up with talks to individual boards of trustees, giving cost of increased lighting and explaining results to be expected. This resulted in two communities making changes to increase to this higher standard at once. Four more made some changes as soon as their budgets permitted. The increased revenue from these changes was well worth the effort put forth, but the good will created thereby and the favorable reaction are of inestimable value. About two years ago, when the San Diego Consolidated Gas & Electric Company started its street-lighting activities in earnest, it had approximately 900 mast-arm and suspension type street lights and 487 ornametal lighting standards. At the present time the company serves about 1,200 of the first-mentioned type and 1,354 ornamental lighting units, either installed or in process of installation. Sixty-four of the ornamental posts are taking the place of obsolete types of ornamental lighting standards, and this will, it is expected, mean the change of a great many more of the obsolete type.

Recent Data on Hydro-Electric Progress in Austria

ACCORDING to a report recently issued by the Austrian Ministry of Commerce and Communications, there were at the commencement of the present year fifteen hydro-electric stations in operation in Austria with an individual maximum capacity of over 500 hp., representing an aggregate of 80,820 hp. There were also 522 stations of less than 500 hp. each, the total in this case being 8,267 hp. No fewer than 244 new hydro-electric stations, representing a total of 292,754 hp., were in course of construction in Austria at the beginning of 1925. The bulk of these plants are of small capacity. There are, however, twenty-four large plants, with an aggregate rating of 286,530 hp., in course of construction, the most important being the Luner Lake station of 60,000 hp. which the Vorarlbergen Ilwerke Gesellschaft is erecting in the Vorarlberg.

Compensated Induction Motor

European Motor Uses Leblanc Principle with One Rotor Having Separate Compensating Winding in Separate Slots— Design Data and Operating Characteristics

By THEODORE TORDA
Budapest

IT IS well known that the improvement of the power factor in existing plants can be solved by means of new devices in addition to the existing ones. The costs of these devices, however, represent an appreciable item for consideration. Such devices as separate compensators, synchronous and static condensers are expensive for small and medium-sized motors and frequently no space can be found for them.

The application of compensated motors is more moderate than it should be if all the advantages connected with them are carefully considered. In all probability the main obstacle to their general application is to be found in the fact that in the forms known they are much more expensive than other motors. Therefore the motor manufacturers have no inducement to complicate their manufacturing program with such a type of machine, for they cannot meet competition. Again, the consumer objects to the higher prices and to the fact that compensated motors are not as simple and foolproof as the induction motor with short-circuited rotors.

A new induction motor with corrected phase displacement has been developed in Europe which represents as simple and in the ratio of output as cheap a type of compensated motor as the normal slip-ring motor. The author's motor uses the primary current on the stator terminals and yet the voltage between the brushes of the slip rings and between the commutator segments is only from 6 to 10 volts. The brushes of the low-pressure commutator have no fixed position; therefore the commutator can be looked upon as a fourth slip ring. With regard to reliability it is close to the normal slip-ring motor and has advantages as compared with the usual types of direct-current or alternating-current commutator motors.

Principle of Motor

The new motor is based on Leblanc's method of connecting the induction motor in cascade with a second machine having an armature winding provided with a commutator and a number of brushes sliding thereon as shown in Fig. 1.

The rotor current with its slip frequency feeds the compensating winding and generates in its active iron a magnetic field. Owing to the action of this commutator this field rotates always with the speed corresponding to the slip frequency; as, however, the compensating winding rotates with a speed exceeding that corresponding to slip frequency, this field will induce electromotive forces in the compensating winding, which drives a wattless leading current through the circuit formed by the compensating winding and the secondary main winding of the motor.

If the ampere turns resulting from this wattless current and the number of rotor turns are equal to the wattless ampere turns of the stator, then the phase-displacement will be totally compensated and the power factor is unity. The generation of the compensator's field being dependent on the rotor current, there will be a correction of power factor, which increases with the motor load. A power factor of 90 per cent can be obtained at about one-third of the normal load and of unity from about half-load upward.

Such twin machines of Leblanc had, however, for small and medium outputs, limited applications owing to their cost and the large space occupied.

In the author's motor these two machines are united in one in such manner that the active iron-body of the induction motor is at the same time the active iron-body of the device improving the phase displacement. By uniting the two machines care is to be taken only that the two magnetic fluxes, those of the motor and of the compensator, shall not exert an influence upon each other. They should act as if they were placed in separate machines.

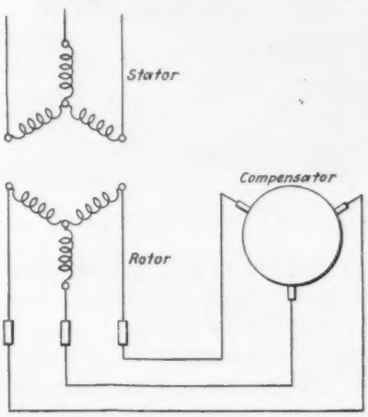


FIG. 1—MOTOR IS BASED ON LEBLANC CASCADE MOTOR CONNECTION WITH THE SECOND ROTOR EQUIPPED WITH A COMMUTATOR

To meet this requirement the motor can be built in such a way that the stator receives the normal winding. The rotor will—besides the normal polyphase winding, connected to the slip rings—be fitted with a second small commutator winding designed for an output corresponding to the magnetizing energy of the motor and with an even ratio between the number of poles of the main winding and of the commutator winding. In this case their mutual induction effect will be zero. Thus the two windings can be placed in the same slots.

It is preferable, however, to arrange the compensating winding in separate slots located on a smaller radius than the slots which receive the main rotor winding, thus permitting the magnetic lines of the compensator to have paths through the rotor iron without interfering with the motor flux. It is possible, even for smaller motors, to remove the channels of the commutator winding sufficiently far from the slots of the main winding so that only a small fraction of the motor flux reaches the commutator winding. This will not interfere with the good working of the motor, even if the ratio of the number of poles of the two rotor windings is an odd number.

A motor built upon this principle will in a given case

have a higher output than the normal type, because, first, the compensating winding is placed in separate slots, so there will be no loss in the useful winding space, and second, there will be a gain through the use of a higher saturation and a reduced number of slots in connection with the compensation.

DESIGN AND TEST DATA

It may be of interest to give the design and test data of one of these motors adapted from a standard induction motor, the stator and rotor windings of which remained unaltered, but the rotor of which received a second row of slots, fitted with the small commutator winding. The 9.5-hp., 1,200-r.p.m., 45-cycle standard motor was changed to a 12-hp., 50-cycle, 1,440-r.p.m., three-phase motor with the compensated arrangement which had the following data:

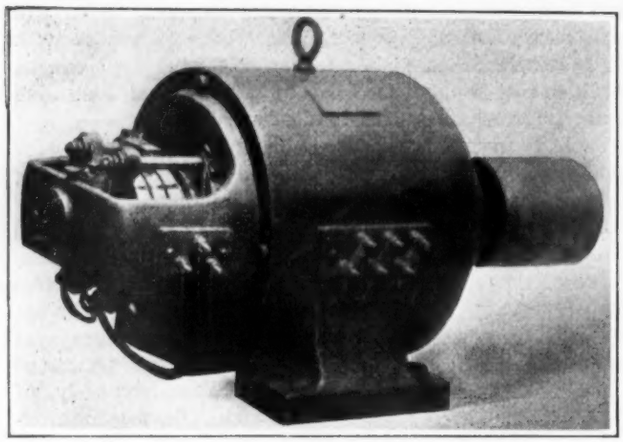


FIG. 2—VIEW OF A COMPENSATED MOTOR

Stator outside diameter, millimeters	300
Iron length, millimeters	140
Bore, millimeters	201
Number of stator slots	36
Number of conductors per slot	12
Size of conductors, millimeters	2/2.2
Cold resistance per phase, ohms	0.142
Connection of phases for 105 volts, 42 cycles	mesh
Simple airgap, millimeters	0.5
Rotor diameter, millimeters	200
Number of rotor slots	48
Number of conductors per slot	8
Size of conductor, millimeters	1.7 × 4.2
Cold resistance per phase, ohms	0.112
Connection of rotor phases	Star
Number of slots of the commutator winding	12
Number of conductors per slot	6
Size of conductor, millimeters	2.3 × 3
Commutator winding	2 poles
Number of commutator segments	36

The rotor-punching had the form given in Fig. 3.

At 105 volts and a periodicity of 42 cycles a brake test of several hours was made. The test results are shown in Fig. 4.

ADVANTAGES OF MOTOR

By the application of increased iron saturation and more copper in the rotor winding the output of a standard motor frame will be increased. Other noteworthy properties of such a motor may be mentioned:

1. Its price per horsepower is not greater than for the normal slip-ring motor.

2. It has asynchronous characteristics, its current consumption is about 15 to 30 per cent less and its efficiency is about the same as that of the normal induction motor.

3. The pull-out torque is about 30 per cent greater than for the normal motor; therefore the compensated type is less sensible to voltage variations.

4. The brushes, unlike the continuous-current motors and compensated motors of other types, have no fixed position; thus the commutator can be treated as a fourth slip ring.

5. Should any fault occur with the commutator or with the brushes, the motor can be used as an ordinary motor and its repair can be effected at any convenient time.

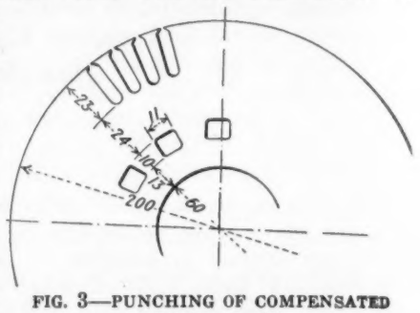


FIG. 3—PUNCHING OF COMPENSATED MOTOR ROTOR

6. In accordance with the approved practice of several decades, the line voltage is applied to the stator terminals, and yet on the slip-ring and commutator brushes, which are in continuous use, the voltage is very low, about 6 to 10 volts.

7. It can be used with both star and mesh connection, for any voltage, for any frequency and for polyphase as well as for single-phase circuits with starting characteristics the same as in normal induction motors.

Considering that this motor with self-excited compensation attains a power factor as high as 0.9 at about one-third load and unity from about half load upward, the conclusion seems to be justified that it solves the power-factor problem as a general purpose motor. In special cases only should simplicity and cheapness be sacrificed by applying external excitation in order that unity power factor shall be obtained from no load to full load.

With regard to the power-factor rates, it may be of interest to mention one, which has found application in Hungary: Two meters are used, a kilowatt-hour W_1 and a reactive kilovolt-ampere meter W_2. The basic unit price is fixed for the case that the reading on W_2 is equal to $0.75 \times W_1$, which corresponds to a power factor of 80 per cent. If W_2 is more than $0.75W_1$, then a penalty is charged; if W_2 is less, a bonus will be given in accordance with the amount resulting from the formula: $(W_2 - 0.75W_1) \div 10$.

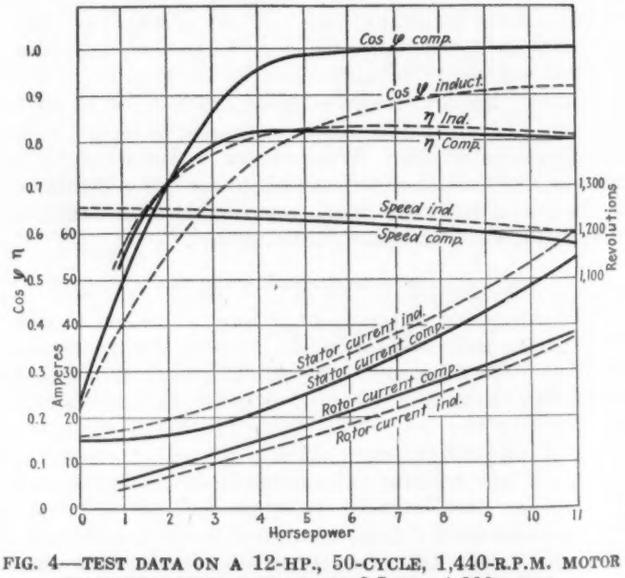


FIG. 4—TEST DATA ON A 12-HP., 50-CYCLE, 1,440-R.P.M. MOTOR COMPARED WITH A STANDARD 9.5-HP., 1,200-R.P.M., 42-CYCLE INDUCTION MOTOR

Trouble Crew and Maintenance Department

Their Effect Upon Public Relations—Bad Impression Caused by Loafing Crews and Gangs That Are Offensive in Their Manners

By A. B. Wollaber
District Manager Southern California Edison Company, Pasadena, Cal.

A UTILITY may boast of the finest offices or the finest office building in the city, the largest steam or gas plant in the state, or may boast of thousands of miles of transmission lines and thousands of partner stockholders, but if it does not reach a proper standard in its relations with its consumers and the public, the value of other satisfactory conditions is considerably minimized. The president of the company, its board of directors, its officers, executives and engineers may be all that could possibly be desired, yet all this may also go for nothing if those employees who are constantly before the public are not well versed in the company's policies in its relations with its consumers or fail to have impressed on them the measure of responsibility each must feel in this all-important work. If the action of a company's employees does not square with the policies published or set forth by the company, the public has no alternative but to doubt the sincerity of the company and its professed intentions.

It is highly important that the service and construction crews go out of their way a little in this regard. Let them be thoughtful and considerate for the rights and feelings of others and many opportunities will arise for proving to a company's consumers the sincerity of the company's purpose to bring about complete and full co-operation with those it serves. Service and construction crews should never be uncivil. Loud talking, sitting around when work is going on instead of keeping busy, drinking out of faucets and letting them run, passing uncalled-for remarks and using improper language in the presence of consumers all have a detrimental effect on public relations. It is sad to relate that these conditions do exist at times in some companies, and those in authority must be on the watch to see that those under them are instructed along proper lines.

Utilities Harm Each Other

There is another element that enters into this important subject, and that is the action of other companies than one's own. How often do officers of a company investigate complaints that come in about some act of the electric company only to find that the offense was committed by another utility! Here a proper sense of responsibility should be felt by all companies, and executives having intercourse should be very frank in stating these cases of complaint that come to them relative to the action of the employees of other companies than their own. There is no place for a half-way or halting position in matters of this kind, and executives should welcome this type of criticism when it comes to them in good faith.

It is not the purpose of this article to appear too exacting, but it seems that the question might well be asked: "Whither are we going and what does any company expect to gain by indifference, discourtesy or disrespect toward the public?" All too frequently one encounters an improper attitude assumed by employees whose duty it is to be civil. If time is taken to observe this attitude, it will be found to pervade in some degree nearly every line of business. Facetious remarks, discourtesy, impatience and many other things that irritate the public are too often met with in daily contact with corporation employees. When complaints are made they are usually coupled with the thought of some change which will bring about relief, and right here is where the municipal ownership advocate gains a point, if not a friend. No opportunity must be lost by employees to place their company in a right light before the public. Misinformation leads to misunderstanding and forms the nucleus for discord and discontent. Then, when these conditions are present, it makes easy work for the demagogue and for those who would pull down what others have been so careful to build.

Loafing Crews

Employees who are almost constantly before the public, in the field where they can be easily observed, are always in a position to bring credit or discredit on the company by which they are employed. While passing through a Western state not long ago a train was stopped just outside of a town and beside a road where an electric utility company was putting in a pole line. After the train stopped the passengers naturally looked out of the windows to observe the cause, and they looked upon a scene that to a utility man was disconcerting indeed. There was a line crew with two groundmen digging holes and about ten other men, including linemen and groundmen, sitting around a tarpaulin which had been spread out on the ground and "shooting craps." This was about 4 o'clock in the afternoon, and the remarks passed in the car were not very complimentary to the electric utility business or to the company concerned in particular.

Charity of thought or a desire to excuse might put this down as an exceptional case which was probably corrected soon afterward. But was it exceptional, and does not this kind of thing happen too frequently in many companies? Not long ago a gas company was engaged in laying a main on one of the finest residential streets in a city. The hour was shortly after noon. The passer-by could not help seeing on the beautiful lawn of a large and handsome church the entire gang of ditch diggers, stretched out after their lunch, with the exception of three or four groups of from four to six men each who were busily engaged in playing cards for money. One can well imagine the impression this must have created. Could there be a more striking example of a disregard for decency than this? And this occurred not ten years ago, but less than three months ago.

The farmer or business man who begins his day early and works late to keep things going sees the construction crews of gas and electric companies pass soon after 8 o'clock on their way to work and observes them returning around 4:30 and naturally asks how much this affects what he is paying for the service he receives from these companies. Now, it is not meant that these men should necessarily work more than eight hours a day, but the manner in which the gangs pass to and from work often creates prejudice. For instance, not long ago a large gang working for an electric company went so far as to stop and jeer at farm hands working in the field as they passed by asking them why they

did not get an "easy job." Later the owner of this farm was approached by a security salesman of this particular company and asked to become a partner in the business, only to be told that the farmer did not intend to put his money into a company whose employees wasted so much time. He further suggested that lower rates might be given if more care were taken by those in charge of the company's business to see that employees worked to better advantage. This reasoning is unjust to the industry, it is true; but here there is an example of lack of forethought on the part of the employees as well as an improper understanding of their responsibility to their chosen work and those the company employing them serves.

ADVANTAGE OF LOOKING BUSY

Passers-by, like the farmer, see the construction crews of the electric utility inactive and men standing around the poles talking. They do not know that this is probably just a short lull in the work and that the men are simply waiting for a line to be drawn up, a tie to be made or something of the sort. On the contrary, they gain a bad impression from what appears to them to be loafing and carry away the idea that their money is wasted because of the idleness of the men they see for the moment. How necessary, then, it is for these crews to keep active, to "show busy" as it were! There is always plenty to do on every job—cleaning up around poles, leveling off small piles of dirt and other work—and while it may seem that these pictures are overdrawn and possibly carry criticism too far, yet it is just things of this character that utility executives must watch if they wish to better their relations with those they serve.

We are in the dawn—only the dawn—of a great movement, one that is destined to transform public relations into harmonious, helpful co-operation between the utility company and its consumers. In the measure in which every one, from the executive down to the lowest in the scale of employees, realizes the responsibility that is his, in that measure will the industry gain the end for which it is looking.

Electrification Helps Alaska Compete in Lumber Industry

FOLLOWING the example of many progressive sawmills in the Pacific Northwest, the Ketchikan (Alaska) Spruce Mills have been completely equipped with ball-bearing motors. Every operation in turning logs into lumber is performed electrically in this mill. Sixty-five motors aggregating 1,750 hp. are installed. During an eight-hour day the mill is capable of turning out 100,000 board-feet of lumber.

W. J. McIntosh, sawmill electrification engineer with Fairbanks, Morse & Company, who designed the electric drive for this mill, reports that it is not so large as some electrically driven mills in Oregon and Washington, but, owing to progressive, efficient management coupled with modern equipment, the total production cost per thousand feet should be at least equal to that of modern Oregon mills in those states. Because of the modern speed reducers employed all shafting has been practically eliminated and the lower loss in transmission is negligible. No friction drives are to be found in the plant, all motors driving mill apparatus through flexible couplings, roller bearings or special gears.

Letters from Our Readers

West Penn Power Company Challenges Zschornewitz

To the Editor of the ELECTRICAL WORLD:

On page 1055 of your issue of November 21, 1925, there is a short letter concerning the output of the electric power station at Zschornewitz, Germany, wherein it is stated that a power station having a total capacity of 140,000 kw. has achieved a daily output of 3,000,000 kw.-hr. The Springdale station of the West Penn Power Company has two 25,000-kva. Westinghouse machines at 80 per cent power factor and two 35,300-kva. Westinghouse machines at 85 per cent power factor, or a rated capacity of 100,000 kw. On October 27, 1925, the twenty-four-hour output of this station was 2,339,000 kw.-hr. with one of the small units out of service for six hours because of lack of station load. If a factor of seven to five is allowed according to the ratings of the stations, this would give the Springdale station a twenty-four-hour output of 3,274,600 kw.-hr. against the 3,000,000 kw.-hr. of Zschornewitz station.

West Penn Power Company, Springdale, Pa. ROBERT L. WEAVER, Assistant Chief Engineer.

Problems of Developing a Business Barometer

To the Editor of the ELECTRICAL WORLD:

I have just read the editorial on "Wanted—A Dependable Business Barometer," appearing in the ELECTRICAL WORLD for November 21, and consider the subject one of great importance. In this connection obtaining correct data from representative industries in different parts of the country is vital. One part of the country will feel a slump more quickly and in some instances more severely than other parts. Slumps will also occur in different localities at different times and from different causes. The writer takes Babson's statistical reports and gets some idea of the country's conditions through them. Considered alone, these reports cannot be relied upon entirely, since they represent only one man's or one firm's opinion regarding the changing tendencies of the times. Through the *Financial Chronicle*, which we also take, we get another insight into the conditions of the country and learn what writers in these financial pages think in this connection.

Possibly a "kilowatt-hour output per day of kilowatt (or horsepower) capacity" would be some indication. Even this, however, would vary because of the rapid progress now being made, in which considerable additional load is continually coming on in the shape of new business and new industries, or of old industries converted to purchased power. If the load factor of the load which is being taken on were higher than that of existing loads, the figures on kilowatt-hours per kilowatt of capacity would show a tendency to increase, whereas if the load factor were lower than the load factor of existing loads, the tendency of the load factor would be to decrease. Still, at the same time, business might be increasing, and in a healthy, stimulating condition.

It is difficult to get hold of any one set of figures which would truly indicate the trend of the times or existing condition. Anything which might be worked out along this line would be appreciated.

Kansas City Power & Light Company, Kansas City, Mo. F. S. DEWEY, Vice-President.

Central Station and Industrial Practice

Essential Qualities in Air-Break Switch

Design of Switches Discussed from Operating Standpoint, Giving Necessary Features for Successful Service—Description of a Proposed Quick-Break Air Switch

BY J. E. REYNOLDS
Chief Engineer Mexico Northern Power & Development Company, Camargo, Mexico

ALTHOUGH there are at present many forms of high-tension air-break switches on the market, few if any of them can be considered to be truly satisfactory either in design or operation. The type of switch referred to is that designed to take the place of the very costly oil circuit breaker for handling small loads or for breaking small currents, such as charging or exciting currents, at all potentials up to the highest operating voltages used today.

In the design of such apparatus there are several features which should be incorporated and which may be enumerated, in order of importance, as follows:

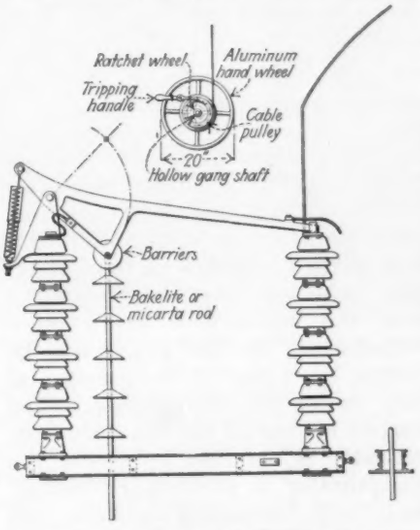
1. The action must be as rapid as possible.
2. The break should take place in a vertical plane.
3. The mechanism must be simple, foolproof and easily adjusted.
4. The cost should be moderate.
5. The insulating supports should not be subjected to heavy tensional or torsional strains.
6. The supports should remain vertical at all times.

There are, of course, several other features equally desirable, all of which have been incorporated in one design or another. It will be found, however, that none of them fulfils all the conditions here laid down and that some well-known types actually fail to meet any of them.

Regarding the first requisite, rapidity of action, experience has clearly demonstrated that this adds greatly to the efficacy of the switch in spite of some early theories to the contrary.

Quick action can be obtained only by a high torque-to-weight ratio, and this value appears to be low in the majority of switches, as the parts are massive and possess excessive inertia. Rapid initial movement will seldom be produced by the action of even large forces upon heavy masses through short levers, and one of the greatest defects of some switches is that the final break begins when the movement is still somewhat sluggish.

The break should commence only when the arm has already attained its maximum velocity, and at this moment the angle the arm makes with the horizontal should be not less than 25 deg., as the movement from 0 to 25 deg. is roughly vertical, rapid separation taking place between 25 and 90 deg.



PROPOSED DESIGN FOR QUICK-BREAK AIR SWITCH

Whatever the torque-weight ratio may be, inertia cannot be eliminated, and the initial movement is bound to be slow. If movement begins from the horizontal position, it will be difficult to attain high speed in an arc subtending only 25 deg., but if movement begins well below the horizontal, a good speed can be attained at 25 deg. above, and a glance at a vertical semicircle will show that this can be done without introducing any objectionable features.

High torque-to-weight ratio can be obtained, of course, by very heavy counterweights or very powerful springs, but either of these methods will introduce severe shocks, as the system has to be brought to rest very quickly and no buffer arrangement can do more than reduce the shock a limited amount.

The evident means of producing rapid acceleration and reducing the shock of still quicker deceleration is to make the moving parts as light as possible consistent with the strength required, and to concentrate the necessarily heavier parts as close to the fulcrum of the mechanism as the design permits.

A quick-break air switch purporting to incorporate these features is shown in the accompanying drawing, which, however, should be considered rather in the nature of a diagram, as for actual operation some of the mechanism would be altered.

The outstanding feature is the reintroduction of a modified "switch-stick" as a permanent part of the switch. This closing member, being only in tension, can be made of a light rod of one of the phenol resin products and it is believed that it can be thoroughly insulated by the use of light cones of the same material in the manner shown.

As the ultimate tensile strength of many of these materials is in the neighborhood of 10,000 lb. per square inch, it will be seen that a small rod would be mechanically capable of carrying considerably more than the probable load required. These materials are also tough, non-extensible and non-hygroscopic.

The extension on the switch-arm serves to give the closing member an approximately vertical motion and the position of the rod would be truly vertical at the "closed" and "open" positions of the switch.

The extremities of the rods can be joined together horizontally and operated by one cable, or they can each be connected by light chain, cable or strip to drums mounted on a common shaft, which in turn may be operated by a hand wheel, crank or motor directly under the switch or at a distance.

Such an apparatus would be easily installed and adjusted, as the mechanism is of the simplest description. Temperature changes would have a minimum effect owing to a small amount of inherent flexibility. There is nothing to cause loss of

alignment as long as the insulators are mounted on a fairly substantial base.

Flashovers from phase to phase should be avoided by the vertical break and by the high-speed feature. The number of insulator stacks is reduced to two, and although the one carrying the switch bearing should be of sturdy construction, the other could be of a much lighter type, which indeed is true of all air-break switches.

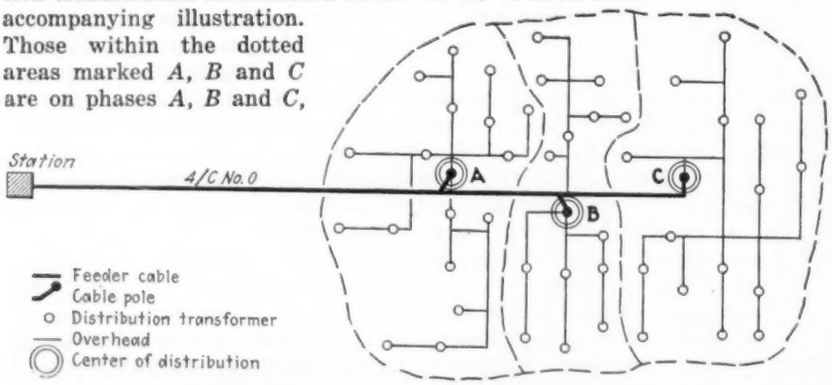
Although such a type of switch as that described may fail to meet with the approval of engineers and manufacturers for one reason or another, it is felt that a useful purpose will be served if this article should give rise to discussion of the general subject. The many varieties of air-break switches on the market today remind an old-timer of the early days of the industry when "experiments" of all kinds were the rule rather than the exception.

Grouping Transformers to Help Voltage Regulation

BY CHARLES R. SCHULER
Commonwealth Edison Company, Chicago

CIRCUITS supplying lighting loads may be easily and satisfactorily regulated by grouping the distribution transformers as indicated in the accompanying illustration. Those within the dotted areas marked *A*, *B* and *C* are on phases *A*, *B* and *C*, respectively. Each phase is arranged so that the pressure at the centers of distribution indicated by the concentric circles is the highest. The drop from the center of this distribution to the most remotely situated transformers of that phase should not exceed 3 per cent.

With a circuit so designed, a recording voltmeter can be connected to the transformer nearest the center of distribution, and with the line drop compensator adjusted to maintain normal pressure on the recording voltmeter, there is a certainty that the pressure at every other transformer on the phase will be within 3 per cent of the pressure at the center of distribution. The correct setting of the line drop compensator is obtained by giving the compensator a preliminary setting equal to the calculated resistance and reactance of the circuit feeder from the station to the point of regulation, including the transformer used to check the regulation. The final setting is obtained by the cut-and-try method of adjusting the compensator until the desired regulation is obtained in the center of distribution under consideration.



TRANSFORMER GROUPING WHICH GIVES BETTER SERVICE

Line Interruptions and Causes

THE Georgia Railway & Power Company operates nearly 300 miles of 110-kv. transmission line, which is largely used to supply Atlanta with energy from hydro plants about ninety miles distant.

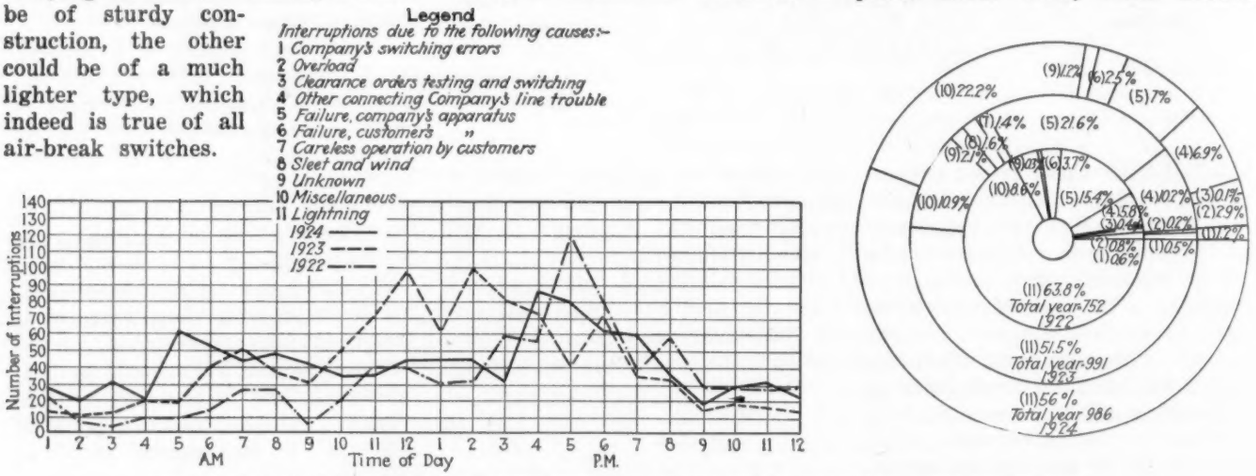


CHART OF 1922-1923-1924 SERVICE INTERRUPTIONS OF THE GEORGIA RAILWAY & POWER COMPANY

For several years efforts have been made to give the best possible service through the use of good relaying and adequate protective equipment. The results are plotted on the accompanying chart in the form of service interruption records. It will be noted that the greatest source of interruption is lightning—namely, 63.8 per cent. Another striking feature is the fact that the interruptions occur in largest numbers between the hours of 4 and 7 p.m.

The record indicated is very good for a large system that is solidly interconnected with other transmission systems and that is located in a country subjected to a great amount of lightning.

Electric Power in Rolling Mills

Reclamation Plant of Santa Fe Railroad Uses 3,500 Hp. of Central-Station Service

ONE of the most interesting power users on the lines of the Commonwealth Edison Company, Chicago, is the Corwith reclamation plant of the Atchison, Topeka & Santa Fé Railroad, Chicago, with a connected load of 3,500 hp., including one 1,500-hp. induction motor and two 500-hp. synchronous motors on rolling mill drives. The work of material reclamation is of almost equal interest to the electric installation itself. This plant, which was

the first and is perhaps the most important one of its kind, operates as a distinct and separate department of the railroad system, its function being to take damaged and broken metal material from all points along the company's system, sorting out such as can be profitably sold as junk, and manufacturing the remainder into usable materials, such as rods and bolts, which find their way into the repair shops of the company.

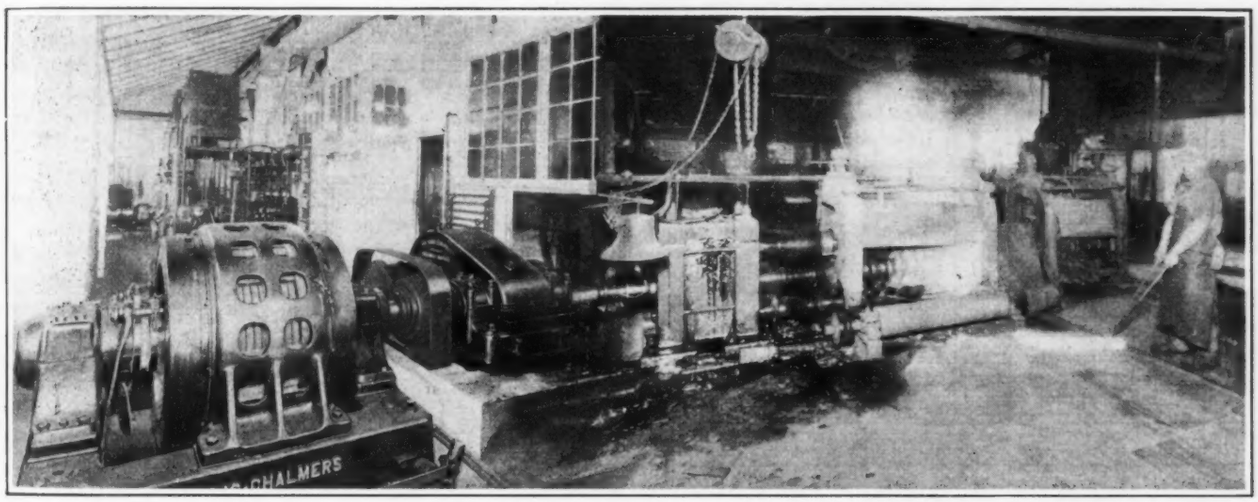
The rolling mill can handle 4,000,000 lb. of metal per month. The reclamation of this amount of metal is carried out by heating the metal and rerolling it into commercial bars. The scrap metal, most of which is wrought iron, is made up into bales weighing from 120 lb. to 200 lb. for the 9-in. and 12-in. mills and 500 lb. to 1,000 lb. for the 22-in. mill. These bales are heated in large oil-fired furnaces to a welding temperature, when they are withdrawn and put through the rolls. The various pieces of metal making up the bale are not melted, but rather welded and fused together under pressure, making a composite bar of extreme toughness and resistance to shock. The success of this method of reclamation has been such that within a single month net profits from operation have exceeded $45,000. The plant is charged with the market price of the scrap at point of origination, plus regular freight rates to the plant, and is credited with the market price of the products manufactured.

For the past six months the two rolling mill units of the plant have been operated with electric power, the old steam equipment having been replaced by two synchronous motors of 500 hp. each and one induction motor of 1,500 hp. One synchronous motor drives a 12-in. rod mill of three stands and the other synchronous motor drives a 9-in. mill of four stands. These two mills are operated in tandem and constitute one unit of the rolling mill department. The 1,500-hp. induction motor drives a 22-in. three-stand mill. All mill drives are of the gear type. The 1,500-hp. motor is equipped with two flywheels mounted on the motor shaft.

A feature of the 22-in. mill installation is a "pull-up" machine for assisting in unloading the furnaces. The installation of electric roll drive made possible such a large increase in production and such increases in the weight of the bales of material handled that the addition of a power-driven machine for unloading the furnaces became necessary in order that the men might unload the furnaces rapidly enough to keep the mills working. This mill is also equipped with an 11-hp. intermittent duty motor for operating the table rolls.

According to the experience of the superintendent of the rolling mill the change from engine to motor drive in this department has effected a saving of at least 33 per cent in production expense. The chief item of saving has been in the ability to get more material through the mill in the same length of time and with the same labor charges. This department, when operating with engines, was able to get out eight 10,000-lb. heats per day and with electric drive ten heats have been produced in the same or even less time. The profit from these two additional heats has more than covered the entire labor expense of the mill. Increased production has come about through the constant speed and greater reserve power of the electric motor and freedom from shutdowns.

Service to the plant is supplied from the 13,200-volt underground distribution system of the Commonwealth Edison Company and is transformed in a substation owned and maintained by the customer. The lighting load is served at 110/220 volts, small-power load at 440 volts and the large rolling mill motors at 2,200 volts. Feeders from this substation to the distribution panels of the various departments are run in tunnels, and branch circuits in departments are run in stone ducts.



SYNCHRONOUS MOTORS REPLACED STEAM ENGINES ON ROLLS WITH SAVING OF ONE-THIRD IN OPERATING COSTS

Raising Power Factor Covers Loss of Generator

ABOUT three years ago the Penn Central Light & Power Company, Altoona, Pa., was placed in an embarrassing predicament by the loss of a 5,000-kw. generating unit in the Williamsburg plant. The new Saxton plant was not in operation, and since all generating equipment was needed to carry the load it seemed that curtailment of service would be necessary. All customers having synchronous motor equipment, however, were asked to overexcite their motors. This request was made by telephone in less than two hours and the system power factor was raised from 78 to 84. This represented a reduction of more than 3,000 kva. in line losses and permitted the carrying of all the load with good voltage regulation during the temporary emergency.

Handling Instrument Transformer Records

BY KARL H. BAUSMAN
Supervisor of Meter Department Dayton Power & Light Company

VARIOUS methods that expedite meter work were pointed out in a previous article by the writer (see ELECTRICAL WORLD, page 1093, November 28). Methods for handling instrument and transformer records are given below.

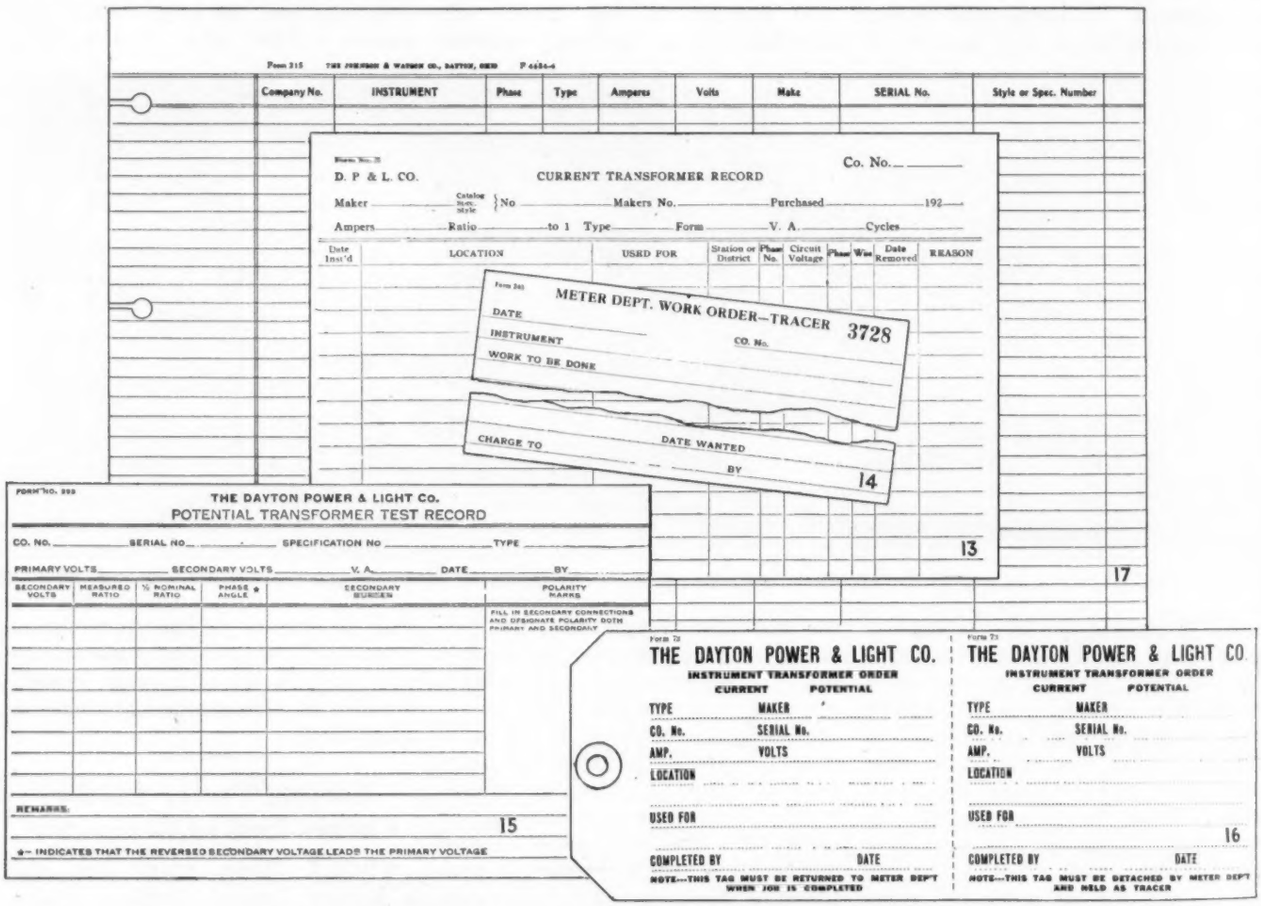
All new instrument transformers (potential and current) are received by the meter department of the company and badged with a proper identification plate indicating the type, ampere or voltage, and company number. Then envelopes (Fig. 13) that will later serve to hold all instrument transformer records (white for current transformers and blue for potential transformers) are filled in with data given on the transformer and are turned over to the primary inspection clerk, who enters the information in the transformer ledger and places the envelope in the transformer stock file according to company number.

Instrument transformers are subjected to a breakdown test and after passing this test are tagged with a breakdown test tag (Fig. 3 of previous article). At the same time a meter department work order (Fig. 14) is made out in duplicate, the salmon copy being put on the transformer, which is forwarded to the laboratory for test. The original of this order stays with the stock clerk to serve as a tracer. In the laboratory the ratio and phase angle are checked, records of which are made on cards (Fig. 15), separate cards being used for current and potential transformers. These records are sent to the stock clerk.

After the tests are completed, the instrument transformers are put in stock, grouped according to ampere capacity or voltage, and a stock ledger record is made of these data. The test records (Fig. 15) are forwarded to the primary inspection clerk, who files them in the corresponding envelopes.

When an instrument transformer is required for an installation, a transformer order tag (Fig. 16) is made out, the stub attached to the transformer and the end filed by company number until the stub is returned, indicating that the transformer has been installed. Then the end of the tag is thrown away and the stub is forwarded to the primary inspection clerk, who makes a record on the transformer envelope showing its location and use. This stub is inserted in the envelope and the envelope is then filed in the live file alphabetically by customer's name and numerically by the company transformer number.

When a transformer is returned from an installation, a recovery is forwarded to the primary demand clerk, who takes the corresponding transformer record envelope out of the live file, indicating the date removed, and transfers it to the stock file. The returned transformer then goes through the same test and record-keeping system as the new transformers.



TRANSFORMER RECORDS USED BY THE DAYTON POWER & LIGHT COMPANY

Fig. 13—Envelope for instrument transformer records. A blue envelope is used for potential transformers. A white envelope for current transformer records.

Fig. 14—Meter department work order. The white original is used as a tracer and the duplicate salmon card is the work order.

Fig. 15—Instrument transformer test record. Potential transformer test record. Current transformer test record.

Fig. 16—Instrument transformer order.

Commercial Activities and Public Relations

Electric Cooking for Institutions

Capitalizing Economies in Building Construction—Severe Duty Demands Rugged Equipment—Miscellaneous Applications Important

By H. E. Kahlert
Commercial Cooking Engineer, Northern States Power Company, Minneapolis, Minn.

NEGOTIATIONS for a commercial cooking installation should begin when the building is being planned, as considerable construction expense can be saved if electric cooking is to be used and this saving can be credited to the cost of electric equipment. For example, no construction of stacks, smoke pipes or ventilating flues is necessary in the electric kitchen, because no smoke, gas or excessive heat is given off. The higher thermal efficiency of electric cooking equipment makes possible the utilization of kitchen space that would be wasted with other methods of cooking.

Some unsatisfactory installations of heavy duty cooking have been made because of lack of understanding just what was required in capacity and ruggedness of construction. If the proper equipment is selected, the performance, durability and maintenance cost are not only satisfactory, but the total cost over a period of, say, ten years is less for electric than for any other kind of cooking apparatus.

Ranges that do most of the top cooking should generally be located out in the room, permitting the chef to work with different utensils all around the range. The absence of smoke pipes makes such an arrangement possible. All apparatus should be located with proper regard for labor saving and light. The ranges, broilers, griddles and roasting ovens should be grouped. Soup kettles, steam cookers and coffee urns can well be separated. More oven space than is provided in the ranges may be needed, in which case a separate broiling oven is supplied. This condition prevails where table d'hôte dinners are the rule.

For commercial applications, the cooking equipment should preferably be connected for 220-volt and, if possible, three-phase service. Such apparatus as large ranges, ovens and broilers have a number of heating elements, each on a separate circuit and protected by a separate fuse block. It is easy to distribute the load of such equipment among three phases. The use of 220-volt service reduces the current carried by the three-heat, rotary switches, thereby reducing the arcing of contacts and lengthening the life of the switches.

An illustration of the practices herein outlined is found in the installation of electric cooking apparatus in the Glen Lake Sanitarium, Oak Ridge, Minn. This sanitarium provides accommodations for 1,000 patients. Electricity for light, power and cooking is supplied from the 13,000-volt lines of the Northern States Power Company.

The cooking problem in this institution consists of supplying three meals a day for 1,000 patients on normal diet and fifty patients on special diet, involving the transporting of meals to different buildings and to individual patients' quarters.

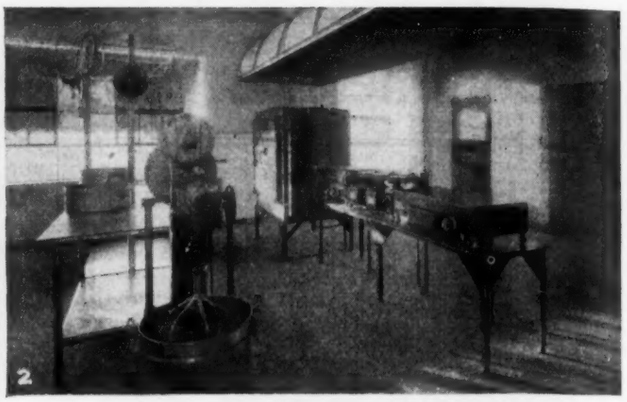
For serving 1,000 meals at one time the range and top cooking surface was of first importance. Although five electric ranges with regular ovens would have provided ample cooking facilities for top cooking and for roasting 250 lb. of meat daily, it was decided to prepare all vegetables in steam cookers, thereby reducing the amount of boiling or top cooking on the range. With this arrangement two Edison ranges would do all the pan frying and broiling. For roasting, an Edison oven having the same available oven space as five ranges was selected. This combination provided oven space at less cost for first equipment and reduced by one-third the floor space required by five ranges. Each range has a top surface 39x48 in. and will handle six 30-gal. standard utensils at one time.

Considerable variation in the menus necessitated some auxiliary equipment. An Edison broiler with a capacity of twenty-two 2-lb. steaks per hour is used for broiled chops and steaks. Waffles and wheat cakes are made on a 36-in. Edison griddle and a three-iron waffle baker. The large variety of baked foods led to the selection of a Dispatch three-deck electric bake oven with a capacity of 219 1-lb. loaves of bread, but also suited for baking fruits, pies, puddings, cakes and other pastries. The oven is large enough to bake a full day's bread requirements at one time. The multiple decks are separately controlled to give any desired temperature. The oven is well insulated

Making Load Demands Clear to the Public

That's what you do to your electric light plant
WHEN you want to say something is elastic, don't compare it to rubber. Say, "As elastic as the equipment in an electric light and power company"
You are continually squeezing that equipment to its smallest limits, and the next minute stretching it out to its full extent. Just consider—
In the middle of the afternoon, maybe, you are not using the electricity at all. Suddenly a storm breaks, darkness closes down and at once you and everybody else in town switch on lights.
This means your electric company must make a quick jump from a small load to a heavy load. You press the button or turn the switch, and great electrical machines respond instantaneously to your touch.
The business of serving you with electric light and power is one which calls for vast equipment and vast capital to maintain it. But more than that, this is a business which demands constant alertness in the men behind the equipment.
You can keep them on the jump—with your rapid ups and downs in the use of electricity. But you can never catch them napping. Try it.
Published by an institution that serves
Cambridge Electric Light Co.

HOW a central station must stand in readiness to serve widely varying demands from the public is well shown in the accompanying reproduced newspaper advertisement of the Cambridge (Mass.) Electric Light Company, which stresses the ability of such utilities to meet instantaneous changes in energy consumption requirements and hints at the costliness of the facilities needed.



Electric Cooking Finds a Wide Range of Application in Sanitarium

No. 1. Two ranges and broiler, 52 kw. connected, on which 3,000 meals are prepared daily.

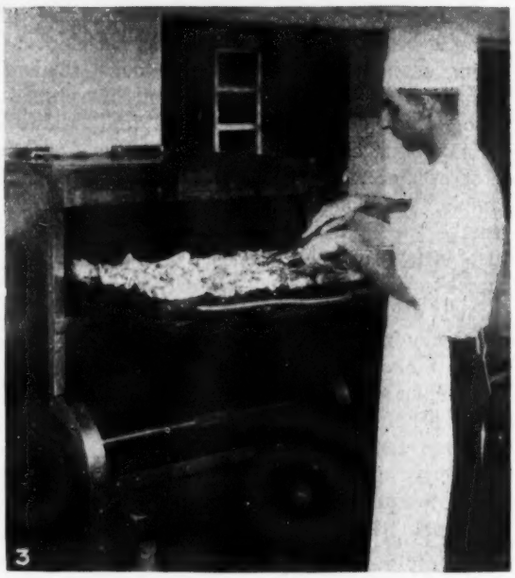
No. 2. Roasting and broiling oven, toaster, waffle iron and griddle.

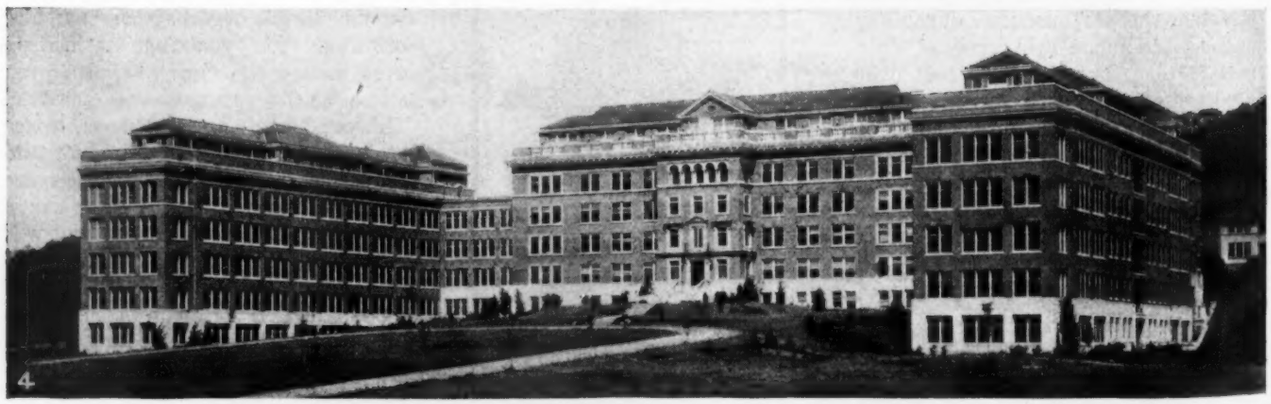
No. 3. Fifty lamb chops cooked at one time on electric broiler.

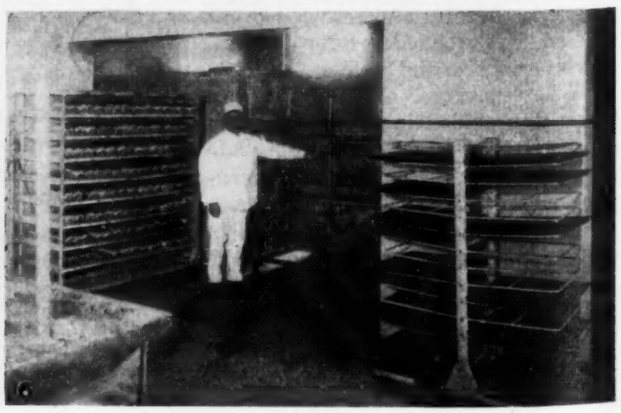
No. 4. Glen Lake Sanitarium, Oak Ridge, Minn., which uses 200 kw. for electric cooking.

No. 5. Portable electric warming table, which may be connected to convenience outlet. Fourteen of these are used in sanitarium.

No. 6. Three-deck Dispatch oven, 25 kw., for baking bread and pastry.







ELECTRIC COOKING APPARATUS,
GLEN LAKE SANITARIUM,
OAK RIDGE, MINN.
Service Supplied by Northern States Power Company

Number in Use	Apparatus	Connected Load, Kw.
1	Dispatch three-deck oven	25
2	Edison ranges	44
1	Edison broiler	10
1	Edison 36-in. griddle	6
1	Waffle baker	4.2
1	Hughes oven	5.3
7	Edison sixteen-slice toasters	21
10	Food trucks with Cutler-Hammer space heaters	18
1	Edison six-slice toaster	3
20	Edison hot plates	20
1	Rutenber range	10
20	Hotpoint toasters	10
3	Hotpoint-Hughes ranges	24
69		200.5

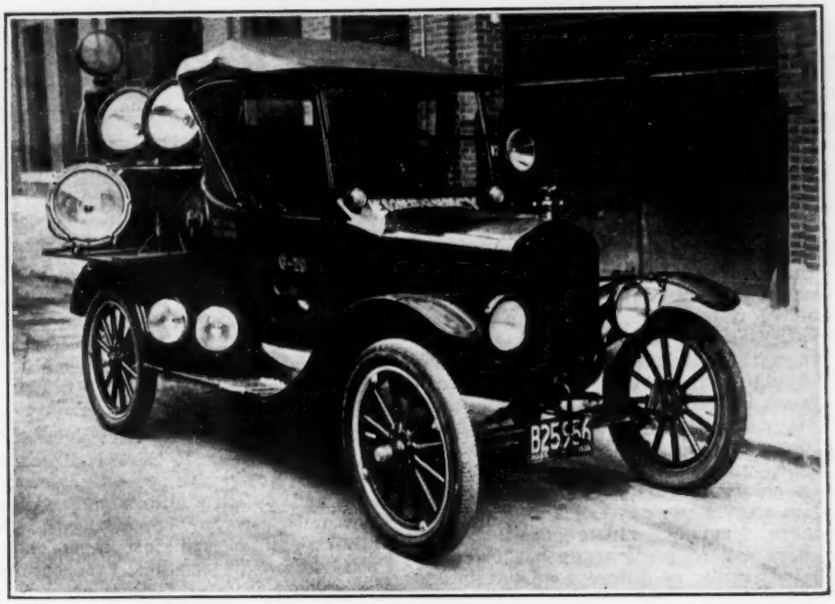
and very little heat is lost into the room, consequently no mechanical ventilation of the room is necessary.

For conveying food to the different wards, floors and dining rooms, specially made trucks, looking not unlike steam tables, were equipped with three Cutler-Hammer space heaters. No water is used, because of likelihood of splashing when trucks are moved into and out of elevators. When the trucks arrive at their destination, their cords are connected to convenience outlets and the food is kept hot as long as necessary. These trucks solved the difficult problem of keeping food warm after leaving the kitchen.

A diet kitchen, supplying special menus for fifty patients, is equipped with a six-burner Rutenber range with two ovens and a six-slice Edison toaster. Two sixteen-slice toasters are used in the main dining room, making 1,000 slices of toast for breakfast. Each of the other dining rooms has a sixteen-slice toaster. The twenty serving rooms, located in different buildings, are each provided with an electric hot plate and a two-slice toaster, connected to the lighting circuits. The separate residences of the superintendent and physicians are equipped with domestic type electric ranges.

First Aid to Fire Fighters

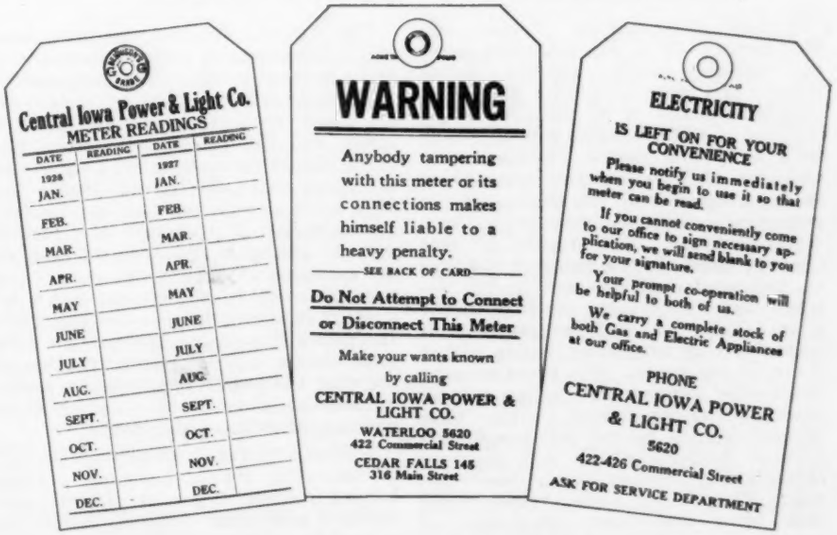
TO ALL night fire alarms the Lawrence (Mass.) Gas & Electric Company sends the emergency truck illustrated herewith, and supplies floodlighting both inside and outside of buildings. The truck consists of a special body mounted on a 1,000-lb. Ford chassis and equipped with 400 ft. of twin cable for attachment to the nearest 110-volt supply circuit. This master reel is connected to three secondary reels, which carry 350, 250 and 250 ft. of twin cable respectively, the cables being connected to three General Electric form L-1, 500-watt floodlights. Two "Portalites" with storage battery supply are also carried.



LAWRENCE (MASS.) GAS & ELECTRIC COMPANY'S EMERGENCY LIGHT TRUCK

Leroy S. Colby, superintendent of the company's electrical department, states that the company has received the highest praise from the fire chief for its assistance, especially in dense smoke; that the truck has been used to aid the police department in drowning accidents, and is helpful in the company's own work at night on poles. One floodlight will illuminate three or four poles in a row, enabling linemen to work as safely as by day. When not in use the lamps are all stowed in the truck body.

Use of Tags to Expedite Service


Central Iowa Power & Light Co.
METER READINGS
DATE READING DATE READING
1926 1927
JAN. JAN.
FEB. FEB.
MAR. MAR.
APR. APR.
MAY MAY
JUNE JUNE
JULY JULY
AUG. AUG.
SEPT. SEPT.
OCT. OCT.
NOV. NOV.
DEC. DEC.
WARNING
Anybody tampering with this meter or its connections makes himself liable to a heavy penalty.
SEE BACK OF CARD
Do Not Attempt to Connect or Disconnect This Meter
Make your wants known by calling
CENTRAL IOWA POWER & LIGHT CO.
WATERLOO 5620
422 Commercial Street
CEDAR FALLS 145
316 Main Street
ELECTRICITY
IS LEFT ON FOR YOUR CONVENIENCE
Please notify us immediately when you begin to use it so that meter can be read.
If you cannot conveniently come to our office to sign necessary application, we will send blank to you for your signature.
Your prompt co-operation will be helpful to both of us.
We carry a complete stock of both Gas and Electric Appliances at our office.
PHONE
CENTRAL IOWA POWER & LIGHT CO.
5620
422-426 Commercial Street
ASK FOR SERVICE DEPARTMENT

USE of tags on residential meters and lighting fixtures to inform new tenants how they can obtain service with the least delay has become quite general among power companies. The Central Iowa Power & Light Company, Waterloo, Iowa, has carried this practice a little further than is usually the custom and makes use of the three forms shown here. Tag "A" is hung adjacent to the meter and meter readers are required to post the monthly readings thereon so that the customer may refer to it at any time. Tag "B," which is printed on red cardboard, warns customers against tampering with the meter, and "C," which is attached to a lighting fixture in one of the principal rooms, notifies the customer that current is already turned on and that the routine application for service can be signed in the office at the customer's convenience or will be mailed to him.

Digest of Electrical Literature

Units, Measurements and Instruments

The Sphere Spark Gap.—R. EDLER.—For quick measurements of high voltages in laboratories and manufacturing plants, where an accuracy of about plus or minus 3 per cent is sufficient, the sphere spark gap is very satisfactory. To insure reliable readings the diameter D of the spheres should be in such a ratio to the distance between the spheres A that A is never smaller than one-half of D and never in excess of $3D$. The author reviews the extensive material available on this subject and compares, in particular, the various exact and approximate formulas. In general, a close check can be made between the formulated results of different approaches to the subject. The comparatively simple way in which the flashover voltage for any given condition can be calculated mathematically makes the sphere spark gap the most valuable voltmeter in existence. In this very detailed paper the author gives the exact mathematical corrections for all the factors which influence such a gap, such as altitude, temperature, etc. Of considerable value is the bibliographic index appended to the article, which gives an international list of all the more important papers ever published on this subject.—*Elektrotechnik und Maschinenbau*, Oct. 11 and 18, 1925.

Hydro-Electric Development and Steam Equipment

Future of Generating Stations.—E. WIKANDER.—The improvements made in modern steam-operated prime movers and their constantly increasing unit size made it possible to bring the cost of the generated kilowatt-hour to a very low figure. Further possibilities of lowering the cost inhere in the avoidance of the change of the generated alternating current into direct current. The result of this cheapening of electric power will entail an unprecedented increase in the demand upon generating stations in the near future, which is estimated conservatively at more than double within the next ten years. For these reasons the author recommends laying out all new alternating-current cable lines without regard to the existing direct-current feeders, which will give an entirely independent three-phase system. This double cable system would also have the great advantage of providing a very valu ble safety reserve or standby in case of emergency. For new power stations it is recommended not to use too large units, as seems to be the present trend. The units should be rated at about one-third of the maximum load. In case of a breakdown such a station would not be so badly affected as one with larger units. Past experience, the author maintains, has shown that power stations, representing the nerve center of large areas, should also be built as nearly bomb-proof as possible, to render them less vulnerable against attacks from aircraft. Heavy walls of reinforced concrete and very light roof construction are recommended. Sheet-steel chimneys, located more than their height away from the power house, and a subdivision of engine room, switch room and transformer room should be considered in spite of the higher initial cost.—*Electrotechnische Zeitschrift*, Oct. 8, 1925.

"Our Wonderful Water Power."—OVE COLLETT.—The author gives very interesting figures to show the reasons why the Norwegian power resources have not, to any appreciable extent, attracted foreign capital. In the author's opinion, the most important of these reasons is the heavy taxes that are exacted from all industries in Norway, the taxes in some cases approaching 50 per cent of the profits.—*Teknisk Ukeblad* (*Norwegian*), Oct. 23, 1925.

Condenser-Leakage Tests.—A preliminary draft is presented by the committee on power test codes of the A. S. M. E. of a chapter of the "Code on Instruments and Apparatus," dealing with condenser-leakage tests. The procedure is specified for these methods: qualitative silver nitrate, quantitative silver nitrate, short direct weight, standard direct weight and electrolytic conductance.—*Mechanical Engineering*, November, 1925.

Heat Applications and Material Handling

The Electric Molder.—ANDREW JENSEN.—Comparative tests on belt-driven and electrically driven molders used in the woodworking industry show that the power consumption of the latter is lower and the production possibilities much higher on account not only of the increased rate of feed attainable but also of the reduced time in making adjustments. The change in a certain mill is stated to have made possible an increase in feed from 60 ft. per minute to 100 ft. per minute and a reduction in direct labor costs per 1,000 ft. from 55.5 cents to 30.8 cents. Data and charts are given in the paper showing the power requirements under various conditions.—*Mechanical Engineering*, Mid-November, 1925.

Electric Spot and Seam Welders.—J. SAUER.—The article describes a number of modern types of electric spot welders and seam welders, useful for a variety of joining jobs, such as mud guards for automobiles, lantern casings, large cans, etc. A novel feature of these machines is that the lower pole of the welder can be separated from the main body of the machine, remaining electrically connected to it by a heavy cable. Simple mechanical drives can be readily attached to these welding machines to change them into seam welders for circular welding jobs. Lessening the electrode pressure, all the described types of welding machines can be used for brass welding instead of sheet steel welding.—*A. E. G. Progress*, October, 1925.

Characteristics of Modern Mine Hoists.—H. WINTER.—Modern installations of electric mine hoists will utilize either a direct-current motor with Leonard control or a three-phase synchronous motor. The author presents a critical investigation of these two systems, assuming that for both cases the most up-to-date machines and connections are used. It seems that the direct-current drive gives under all conditions the most flexible operation. Where this feature is not of absolutely first importance, and particularly where lower first cost is demanded, the large induction motor with rotor short-circuiting arrangement and regulating brake will give excellent service. Great and important improvements have been made on the three-phase drive for mine hoists in late years, so that today this method approaches very closely the undisputed advantages of the Leonard system direct-current operation.—*Brown, Boveri Mitteilungen*, November, 1925.

Transmission, Substations and Distribution

New Electric Regulator.—G. PICKER.—This new voltage regulator is based upon the Tirrill principle, but instead of vibrating its short-circuiting contacts electromagnetically, it is mounted directly on the shaft of the regulated generator and a small exciter on the shaft vibrates the contacts mechanically. A small solenoid with an iron plunger acts upon the upper of the two vibrating contacts and thus varies the periods of contact making. This arrangement operates with perfect satisfaction for up to 5 amp. and 250 volts. These limits may, however, be shifted up to generators of 400 kw. with intermediate relays. On account of its great simplicity and very low cost this new voltage regulator should be of great value for small, isolated generating plants such as small railway stations, wind-power plants and rural stations.—*Elektrotechnische Zeitschrift*, Nov. 5, 1925.

Three-Phase Versus Single-Phase Transformers.—K. LUBOWSKY.—The old question whether a certain transformer capacity should be built as one three-phase unit, as is customary in Europe, or as three single-phase units, as is customary in America, is again being discussed, the arguments being based on modern experiences. Among the few advantages still claimed for the single-phase type are the larger possible capacity for self-cooled banks and cheaper repairs in case of damage to one phase. In virtually all other respects the three-phase machine is held to be the more advantageous type. Cheaper first cost and more efficient operation will always be strong arguments for three-phase transformers. The general introduction of butt joints on transformer cores, making coils and coil groups much more accessible, is another feature which lessens any difference between the two types of machine.—*A. E. G. Progress*, October, 1925.

Loading Transformers on a Temperature Basis.—E. G. REED and W. A. SUMNER. — Tests on a distribution transformer provided with thermocouples in the winding showed that for 100 per cent load, maintained until a steady state had been reached, the hottest spot temperature did not exceed by more than 7 deg. C. the average as determined by resistance; for 125 per cent load the excess was 11 deg. C. Corresponding differences between oil and average winding temperature were 10 deg. and 14 deg. respectively. Heating was also determined when a load cycle, selected as typical for a certain kind of service, was applied. From these studies it is concluded that for transformers having the heating characteristics of the one tested and operating on a daily cycle of no greater severity than that assumed in the trials a peak load of 125 to 150 per cent of the normal rating is not excessive from the heating point of view. Performance charts on which the conclusions are based accompany the article.—*Electric Journal*, November, 1925.

Electrophysics, Electrochemistry and Batteries

Study of Liquid Dielectrics.—Part I. —WHEELER P. DAVEY and THOMAS A. WILSON.—The authors have with the aid of specially devised apparatus conducted a series of experiments, which are described. Because of its mobility, a liquid dielectric shows to an exaggerated degree the phenomena experienced in a solid dielectric, such as the effects of colloidal moisture, higher temperature, local heating and chemical changes. The commonest liquid dielectrics are the mineral oils, of which transil oil is a representative. It has been found that whatever changes may be produced in this oil by corona, intense local heating, or spark, will likewise be produced in linseed oil to a greater degree. The authors have therefore used this latter substance in their investigations. The studies described in the present part of the paper deal with the behavior of paper spacers impregnated with the oil and used as the dielectric of experimental condensers across which fairly high potentials were impressed. Test results are tabulated, showing the direct-current leak and corresponding resistance under various conditions. In summary, it was found that (a) absorption of linseed oil by the spacer causes the segregation of originally contained water and air into bubbles; (b) removal of this contained air and water from the spacer increased the effective resistance of condensers to direct-current leak 12,000 times at room temperature and 900 times at about 90 deg. C.; (c) removal of air alone from the dielectric (the moisture being allowed to remain) increased the effective resistance over 140 times; (d) extreme removal of contained air, water and volatile oxidation products from both spacer and dielectric increased the effective resistance to direct-current leak about 4,500 times at a temperature of about 90 deg. C. —*General Electric Review*, November, 1925.

Losses in Iron Under the Action of Superposed Alternating-Current and Direct-Current Excitations. — O. E. CHARLTON and J. E. JACKSON.—By means of wattmeter measurements on a small experimental reactor it was found that there is a comparatively small change in core loss as direct-current excitation is added, the core loss even showing a decrease when the alternating-current saturation is high. However, no scheme has yet been devised for eliminating the copper loss due to the double-frequency circulating current; the only remedy appears to be to use sufficient copper. — *Journal A. I. E. E.*, November, 1925.

The Valve as an Oscillation Generator.—DALLAS G. BOWER.—The essential phase relations in the several parts of the circuit are briefly explained. It is shown that if the anode current oscillates over the whole of the characteristic, falling to zero and rising to twice the direct current from the battery, the efficiency cannot exceed 50 per cent. It can be increased above this value by so adjusting the plate and grid potentials that a current pulse comes in the positive half cycle while the negative half cycle is to a greater or less degree suppressed by the negative grid. This introduces powerful harmonics, so that the increased efficiency is secured at the expense of purity of wave form.—*Electrician* (*England*), Oct. 9, 1925.

Electro-Osmotic Purification of Water.—E. MAYER.—Water which contains salts in solution may be desalted by the electro-osmotic process, which is based upon the fact that if two electrodes are placed in that water and if a direct current is passed through the electrodes and the water, the acid-anion component of the liquid will travel toward the positive electrode, while the metal-cathion component will go to the negative pole. To purify water with this method requires triple cells, with the water in the middle compartment and the two electrodes in the right and left vessel. The two walls between these three compartments are made of a porous material readily penetrable by the current. Ten of these cells are arranged in series. Depending on the amount of salt to be removed, an energy consumption of 0.4 kw.-hr. to 2.5 kw.-hr. is required for every 100 liters. This is very materially less than the energy required for distillation of the same amount of polluted water. The apparatus can be built on a large scale, operates automatically and needs but little attention.—*Elektrotechnik und Maschinenbau*, Oct. 18, 1925.

Telegraphy, Telephony, Radio and Signals

Optical Time Signal.—I. WILIGUT.—It is customary in large shipping ports to indicate the exact time to vessels by signal lamps. The article describes installations of this kind in operation in two European ports. Every four hours high-power incandescent lamps—one or more—mounted in properly directed reflectors, are illuminated five minutes before the intended time signal, and when the sixtieth second of the given time instant has elapsed the lamps are extinguished. An exact time clock operates a series of relays, which close and open the circuit for the signal lamps. A small battery supplies the current for the relays. Experience has shown that these signal lamps can be seen plainly for many miles even during bright sunshine. One of the installations referred to employs one 4,000-cp. searchlamp, while in the other twelve lamps of 1,000 watts each are arranged near the top and around a high factory chimney.—*Siemens Zeitschrift*, September, 1925.

Submarine Telephone Cable. — P. CRAEMER and E. MULLER.—Valuable data were collected during the manufacture and laying of a Pupinized submarine cable from the German coast to the island of Sylt. The enterprise was considered as an experiment on a very large scale with absolutely satisfactory final results. Two large German cable firms each supplied one of the two cables. Each cable contains seven main trunks with four conductors, or a total of fourteen pairs of wires. The cables are armored with a layer of twenty-seven heavy, round steel wires and one outer lead sheath. Specially designed induction coils with compressed ferrous dust cores are built into the cables approximately every 2,400 m. The outer diameter of the cable is 66 mm., which is increased to 140 mm. at the points where the coils are built in. These heavy swells at the cables proved no handicap in paying the cable out of an ordinary cable-laying ship. The only mishap, one due to kinking, occurred on a piece of the straight cable. A single lead sheath, which was adopted hesitatingly, proved to be entirely sufficient. An armor of round wires on a Pupin cable seems to be superior to one made of Z-shaped wires, because the latter have a tendency to belly out at the coil swells. Many tabulations of all the characteristic data of the two cables are given in the very detailed paper.—*Elektrotechnische Zeitschrift*, Oct. 15 and 22, 1925.

Traction

Main-Line Railway Electrification.—No. X—France—SIR PHILIP DAWSON and S. PARKER SMITH.—The publication of exhaustive data, on which comment has previously been made in connection with this series, is continued. It is estimated that when the total projected electrification scheme has been completed the saving in railway coal will exceed 1,500,000 tons; the total capital expenditures will be about 5,025,000,000 francs, and the energy consumption (in 1933) will be 2,260,000,000 kw.-hr.—*Engineer* (*England*), Oct. 23, 1925.

Corcovado Railway (*Brazil*).—The steam road which until recently ran to the top of the mountain at Rio de Janeiro gave uneconomic service owing chiefly to the high cost of coal in Brazil. The road was recently electrified and now operates on 750-volt, 50-cycle, three-phase current, the locomotives being similar to those on the Jungfrau railway in Switzerland. The heavy grade, presenting an average of one to six and a maximum of one to three and a third, made cog-rail opera-

tion necessary throughout the entire 2½-mile length of the road. Each engine carries two 155-hp., three-phase induction motors with slip-ring armatures, which operate over double herringbone reduction gears. The total reduction of 1:11.3 gives the engine an average speed of 5½ miles per hour. To forestall rack climbing in case of excessive train resistance, a friction coupling is inserted between the second set of gears and the cogwheel. Down-grade regenerative braking can be applied. The complete locomotive weighs 15 tons and has 3-ft. 3-in. gage. Two overhead trolleys and bonded rails supply the three-phase current. A power consumption of 520 watt-hours per ton-mile was measured, of which 45 per cent was regained on the down grade.—*Bulletin Oerlikon*, September, 1925.

New Books

Usines Hydroélectriques

By Charles L. Duval, lecture master of the École Supérieure d'Électricité, director of electric applications of the Société Générale d'Entreprises. Followed by **Reglage des Groupes Electrogènes**, by J. L. Routin, lecture master of the École Supérieure d'Electricité, consulting engineer for Schneider et Cie. Paris: J. B. Fallière et Fils. 512 pages, 317 line drawings and photographs.

This volume is the development of lectures on hydro-electric plants delivered by M. Duval at the École Supérieure d'Électricité. It comprises, as a whole, a general consideration of the management of hydro-electric properties. Certain matters are treated in summary fashion, and simply from the hydro-electric viewpoint; such is the case, in particular, with the questions of distribution lines and rates for energy. The authors have assembled complete descriptions of diverse hydro-electric systems with the reasons for particular designs and arrangements of parts.

Industrial Furnaces

Vol. II. By W. Trinks. New York: John Wiley & Sons. 405 pages, illustrated.

At last a worth-while book on industrial heating furnaces has arrived. This volume takes up the practical side of furnaces and their applications and thoroughly treats of the principles and practices of today. Gaseous, liquid and powdered fuels are discussed, as are the methods for burning them most effectively. Then the author treats of electric resistors and their application and describes the fundamental types of furnaces used. The control of temperature, the control of time and temperature relations and the handling of products to and from furnaces are discussed in an adequate manner.

Furnaces are treated as production agents by Professor Trinks, and labor, structure and control devices are treated from the standpoint of production. Every man interested in industrial furnaces will find this volume of great practical value. It is unfortunate, however, that the author does not go into more detail in regard to the designs and applications of electric furnaces.

Alternating-Current Circuits

By J. M. Bryant and J. A. Correll. New York: McGraw-Hill Book Company, Inc. 412 pages, illustrated.

An elementary textbook on alternating-current circuits cannot contain much that is not found in other books; authors of such books have a choice of selection and of treatment only. This text is noteworthy for its thorough derivation of fundamental circuit relations and for its applications of the theory to transmission problems. Rigid mathematical derivations are used, and several methods for the solution of transmission-line problems are considered. Transient circuit conditions are not considered by the authors.

A large number of illustrative problems aid in clarifying the text and in fixing the principles. This new text is sure to be considered favorably by many teachers.

The Dynamo, Its Theory, Design and Manufacture

By C. C. Hawkins. Sixth edition, revised and rewritten. New York: Isaac Pitman & Sons. 572 pages, illustrated.

A thorough treatment of the modern alternator is a welcome addition to machinery literature. The author has thoroughly revised and rewritten this standard work, and it now covers admirably the latest elements in theory and design associated with alternators. Armature windings of all types, computation methods for determining voltage waves on alternators, armature reactions, construction features and complete assembly and performance data on turbo-alternators are treated in the text. An additional chapter that will be welcomed treats of alternators in parallel. While written primarily from the viewpoint of the designer, the book contains valuable material for the student and also for the practicing engineer.

Guiding Principles of Public Service Regulation

By H. C. Spurr. Vol. II. Rochester, N. Y.: Public Utilities Reports, Inc. 750 pages, illustrated.

The editor of *Public Utilities Reports* has done a workmanlike job in this volume. It is delightful to find a book on this broad subject so free from personal opinion and so replete with court and commission decisions. The author has compiled and analyzed decisions to arrive at his conclusions and cites cases freely to support his statements. The contents of the book cover pavement over mains, land and buildings, property not used and useful, abandoned and superseded property, standby equipment, property acquired for future needs, depreciation and depreciation reserves, rates of return, operating expenses, amortization charges and a number of other topics of interest to utilities. This authoritative work forms, as did Volume I, a very useful addition to present-day literature on regulation.

If the author had summarized the weight of evidence or of decisions on major topics now in controversy, the book would have been still better. There are so many conflicting opinions and decisions that the reader would welcome a little argumentative opinion and reasoning from an author who is familiar with his subject. As written, the reader must study cases carefully and read the text carefully before he can arrive at a decision on controversial topics. On the other hand, the book is so unbiased by the personal opinion of the author that the reader accepts it as a compilation of really valuable material upon which to base his own opinions.

Book Notes

Industrial Electricity. Part II. By Chester L. Dawes. New York: McGraw-Hill Book Company, Inc. 480 pages, illustrated.

Professor Dawes' second book takes up the fundamental circuits, relations and machines existing in the realm of alternating currents. In addition there are chapters on transmission and distribution, electron tubes and interior wiring. The volume is an elementary textbook with lucid explanations and good illustrations. It is not a practical book in the sense that it takes up any industrial applications in detail, but the industrial worker will find that it covers the theoretical principles of electricity in a splendid manner. Illustrative problems help materially to clarify the technical explanations.

Electrical Engineering Problems. Part I. By J. G. Pertsch, Jr. New York: McGraw-Hill Book Company, Inc. 208 pages, illustrated.

In this text Professor Pertsch has printed a list of problems on direct-current circuits and apparatus. These problems have been used in classes at Cornell with great success and should prove valuable to teachers in other schools. The illustrations are clear and complete, and most of the problems have been written from the standpoint of practical applications in engineering.

Chemistry in Modern Life. By S. Arrhenius and C. S. Leonard. New York: D. Van Nostrand Company. 285 pages, illustrated.

This is a fine addition to the Modern Science Series, which has done much to educate the public in the mysteries of science. It is a Swedish book, ably translated by Mr. Leonard, and is well written. It delves into the origin of matter and the early conception of chemistry and strongly pictures the application of chemistry to modern conditions. A valuable chapter on "Electricity and Chemistry" goes far to make clear their interrelations and what they can do in combination.

Chart for Copper and Alloys. By Charles H. Hughes, New Dorp, Staten Island, New York.

This 22-in. x 17-in. chart is arranged in three vertical columns, headed "Copper," "Alloys" and "Tables." Under the column "Copper" are paragraphs on copper ores, methods of extracting copper, grades, commercial forms, physical, chemical and electrical properties, etc. The column "Alloys" contains chemical proportions and properties of alloys, while the column "Tables" gives tables on copper and brass sheets, pipes, tubes, comparison of gages, etc.

Books Received

Elektromaschinenbau. By P. B. Arthur Linker. Berlin: Julius Springer. 304 pages, illustrated. Price, 24 gold marks.

Wirkungweise der Motorzähler und Meszwandler. By J. A. Möllinger. Berlin: Julius Springer. 238 pages, illustrated. Price, 12 gold marks.

Annual Report of the Board of Regents of the Smithsonian Institution. Washington: Government Printing Office. 535 pages, illustrated.

Power Plant Lubrication. By William Farrand Osborne. New York: McGraw-Hill Book Company, Inc. 275 pages, 84 illustrations. Price, $3.

News of the Industry

To Approve Conowingo

Pennsylvania Commission's Alterations Accepted by Philadelphia Electric —Maryland Favorable

SANCTION from both the Pennsylvania Public Service Commission and the Maryland Public Service Commission seems assured for the fifty-two-million-dollar hydro-electric project at Conowingo, Md., with a potential output of 500,000 hp., which has been hanging fire for months. In a formal report the body first named indicated on December 4 that it would approve the project if certain changes in the financial program of the promoting companies were made. The companies concerned in the application are the Philadelphia Electric Company, the Susquehanna Water Power Company of Pennsylvania, which owns all the real estate in Pennsylvania involved; the Susquehanna Power Company of Maryland, owning the dam and real estate in Maryland, and the Susquehanna Electric Company of Maryland, operating the plant.

These changes include the provision of a 7 per cent return upon the actual investment, rather than the payment of an annual rental of $4,580,000 by the Philadelphia Electric Company; that class A common stock of the Susquehanna Water Power Company be eliminated, to do away with any opportunity for speculation; that the same company shall not issue any preferred stock with a dividend rate of more than 8 per cent, and that the books of the Maryland as well as the Pennsylvania companies be open to the Pennsylvania commission for inspection at all times. Regarding a plan of fixed return, based on rentals, rather than that of a 7 per cent profit, based on actual investment, the commission says:

"Due to the comparatively fixed return on the property (viz., a minimum of $4,580,000 per annum and an estimated maximum of $5,103,000), the consumers would neither bear the burden of necessarily increased costs of construction or obtain the benefits of decreased costs of construction. In our judgment, it is in the public interest to afford the applicant an opportunity to modify the contracts in accordance with the foregoing principles before we finally dispose of the applications."

"A most persuasive feature to the commission," the report says, "is the fact that the development would be of great value in the conservation of natural resources, as the initial installation is estimated to result in an annual saving of 684,000 tons of coal, which may be increased later to a saving of 1,000,000 tons yearly."

On the recommendation of President Walter H. Johnson, the directors of the Philadelphia Electric Company accepted the commission's modifications in their financial plan.

Speaking for the Maryland commission, President Harold E. West said that prompt ratification seemed assured. He pointed out that the Maryland body holds full power to inspect the books and operating details of the two Maryland companies, which are the power-producing companies. Therefore, he said, there will be no need to require books of the Pennsylvania companies to be open to the Maryland commission. In fact, agreements for exchange of such information already exist between the two commissions.

The Maryland commission's order, Mr. West said, will contain stipulations that power to be sold in Maryland must be sold through the Maryland companies. The commission will not permit this power to be sent to Pennsylvania and into interstate commerce, which might cause additional transmission charges to be added to the Maryland rates.

Edison Medal Awarded to Harris J. Ryan

The Edison medal for the year 1925 has been awarded by the Edison medal committee of the American Institute of Electrical Engineers to Harris J. Ryan, professor of electrical engineering at Stanford University, California, "for his contributions to the science and the

H. J. RYAN

art of high-tension transmission of power." Professor Ryan's accomplishments are too well known to electrical engineers to need recounting. During his twenty years at Stanford he has been a pioneering leader in high-voltage transmission. When about three years ago the first 220,000-volt power lines were successfully put into commission by California companies, he cooperated with the engineers in finding ways to cope with the insulator problems encountered. On the solution of similar problems his genius in the research field is expected to continue an outstanding advantage to science. Professor Ryan before going to Stanford was for ten years professor of electrical engineering at Cornell.

Fears Extrastate Control

Massachusetts Commission Seeks Law Giving Power Over Foreign Holding Companies

DECLARING that the advent of holding-company control into New England carries with it the liability to the evils of absentee landlordism, the Massachusetts Department of Public Utilities has recommended legislation at the forthcoming session giving the board jurisdiction over electric utility contracts exceeding one year in term and extending the present statute relative to the dissolution of domestic utilities which may be acquired by foreign corporations to include holding companies from outside the state. Commenting upon these proposals, the commission says:

"The control and operation of a number of New England electric companies has this year passed into the hands of groups of outside capitalists. Some advantages may flow from this in so far as these consolidations form part of a superpower development, so called, as has been pointed out by Secretary of Commerce Hoover, but there are also disadvantages if such developments are controlled by interests outside of New England. All the evils of absentee landlordism are liable to obtain. Danger exists that the hydro-electric power of New England may be exported at the expense of the industrial and agricultural development of the commonwealth. The creation of superpower systems is also bound to involve the making of contracts between the interlocking companies for the interchange of electricity. If this department is not in a position to control these contracts, we may be confronted in the future with the argument that Massachusetts cannot inquire into their propriety in rate cases. This seems to be the view of the Supreme Court of the United States in relation to the telephone contracts. Legislation at this time may also prevent serious question in the future as to the power of this commonwealth to regulate and control the exportation and importation of electricity. Moreover, rate regulation is bound to be crippled if such contracts exist in particular cases and must be dealt with as established facts, although they have not received the approval of this department.

"We accordingly recommend legislation to the effect that any contract by a public utility for the supply of electricity or power for a period in excess of one year should be subject to the approval of this department and should in the absence of such approval be void.

"General Laws, Chapter 181, Section 10, provides that whenever a majority of the stock of a domestic corporation becomes owned or controlled by a foreign corporation and such foreign corporation issues stock, bonds or other evidences of indebtedness based upon or secured by the property, franchise or

stock of such domestic company, the Attorney-General, by appropriate proceedings, may petition the Supreme Judicial Court for the dissolution of the domestic corporation thus owned or controlled and the Supreme Judicial Court may dissolve it. We think that the same evils exist whether such a majority is owned or controlled by a foreign corporation or by a foreign trust or association or whether such foreign owner does or does not issue securities against its ownership or control thereof, and that the law ought to be amended and extended accordingly. We are also of the opinion that the pivotal stock is the common stock and such other stock as has like voting powers and that the law should be made more specific in this regard."

Congress Will Go Slow on Muscle Shoals

Futility of Passing Legislation for Public Operation with Presidential Veto in Background Is Recognized—Senator Norris Disputes Coolidge's Contentions

CONGRESS is going to be in no hurry to take up the disposition of the government's Muscle Shoals properties. This has been indicated on each side of the Capitol. Senator Watson of Indiana goes so far as to predict that there will be no legislation at this session. While it is recognized that there is much valuable material in each of the reports made by the Muscle Shoals Commission, the consensus of opinion seems to be that the reports are not likely to change any votes.

The President's reference to Muscle Shoals in his message to Congress is expected to exert a profound influence on public opinion, but it will take time for that fact to become evident. In the meantime it is assumed that Congress would not be ready at this time to go as far as the President suggests. From the definite way in which the President condemns public operation it is assumed that he would veto any legislation containing such a proposal, which makes it the more certain that no such plan can be put through. The evident feeling displayed in his reference to the incapacity of the government to deal with an industrial and commercial problem is thought to have been prompted by his experience with the Shipping Board. It is thought that he has visualized the much greater difficulties which would surround a government foray into the fertilizer business.

In connection with the President's recommendation for the outright sale of the properties it is understood that fully two-thirds of the government's outlay can be obtained for the properties from those who are familiar with the conduct of the enterprises which best can be conducted there. Apparently the power industry, the fertilizer industry and the majority of the people in the South are very favorably impressed with the President's recommendations, although there is no great likelihood that Congress will accept them at this session.

Notwithstanding this Congressional inertia, however, the transfer of the government's interest in the Muscle Shoals properties to private hands, as recommended by the President, is contemplated in two resolutions presented in the House on Wednesday. One was offered by Representative Snell of New York, chairman of the rules committee, and the other by Representative Madden of Illinois, chairman of the appropriations committee. The measures differ slightly in form. They were both referred to the rules committee.

In this connection interest attaches to a resolution introduced into the Senate by Senator Pittman of Nevada which would deprive the Federal Power Commission of authority to grant licenses on the Colorado River or its tributaries until February, 1928, or until the policy of the federal government in regard to Boulder Canyon shall have been settled. If this resolution should pass the Senate and reach the House, an attempt is likely to be made in the latter body to pass a similar resolution affecting the Tennessee and Muscle Shoals. In this manner all jurisdiction by the Federal Power Commission over the two rivers which loom so large in national politics would be suspended.

SENATOR NORRIS' CRITICISM

Senator Norris of Nebraska, a consistent advocate of government ownership, has given out a statement in which he calls President Coolidge's recommendations "not surprising but indefensible." He disputes the President's view that the importance of Muscle Shoals has been exaggerated, maintaining that the decision will establish a precedent of great weight. The most significant paragraphs of Senator Norris' statement are those that follow:

"The President recommends that the power shall be used primarily for the production of nitrates—fertilizer—and only incidentally for power purposes. If President Coolidge were reasonably well posted upon the Muscle Shoals question, he would know that every scientific man in the country who has given any close study to the subject has reached the conclusion that improvements in cheapening the cost of fertilizer all tend to the use of less and less power. The farmers of America have been given to understand that we can use the power and machinery of Nitrate Plant No. 2 at Muscle Shoals and cut the cost of fertilizer in half. This is propaganda that has gone over our country, backed by those who do not want the people, particularly the people of the South, to get the benefit of cheap electricity, because it would interfere with the electric power trust. It is to be regretted exceedingly that the President continues to align himself with those who are misrepresenting the facts to the farmer.

"It is conceded by all that electricity in the modern home is practically as necessary and as common as water. It is likewise conceded that the combining of all generating systems into one giant power scheme is the most economical way of generating and distributing electric current. It follows, then, that the economy of the problem means a monopoly, and the question before the American people is whether this monopoly shall be governmentally owned or privately owned. The President wants a private monopoly. Muscle Shoals occupies a key position. It creates electricity from a great navigable stream. It has been developed and paid for by public funds. It is now owned by the government. Properly used and handled, it can become a part of a giant power system in the South that will carry electricity into all the homes in that portion of the country, and even though it be combined in a general power system with other privately owned systems, the government can use it as the means by which the people can be safe from exorbitant prices. In case of war we would need the property we now own at Muscle Shoals. If we give it away now and war should come, we will buy it back at an enormous price. Since we own it and since it is the development of one of our natural resources, why should we give it to private interests for private gain?"

Big Plant at Fort Lauderdale for Florida Power & Light

Growing demand for electric power in Florida has caused the completion of negotiations by the Florida Power & Light Company for the purchase of a large tract of land on the New River near Fort Lauderdale, on which work will be begun immediately for the construction of a new steam-electric generating station to have an ultimate capacity of 100,000 kw. or more. Orders have already been placed for two 25,000-kw. high-pressure steam turbines, boilers and auxiliary equipment for this station, and it is expected that the first unit of the plant will be installed and in operation by the end of 1926 or early in 1927. This station will be equipped to burn either coal or fuel oil or both, and rail and water transportation will be available for fuel deliveries. It will be one of the largest in the South.

The Florida Power & Light Company, which with its associated companies is a subsidiary of the American Power & Light Company, New York, has, besides, under construction a new plant on the St. Johns River, near Sanford, Fla., designed for an ultimate capacity of 100,000 kw.

The electric generating stations of the Florida Power & Light Company and its associated companies and the distribution systems in all the communities served on the lower east coast are now being interconnected by a 60,000-volt transmission line, 120 miles in length, which will be entirely in operation by the end of this year. (See ELECTRICAL WORLD for October 3, page 713.) The new Fort Lauderdale plant will be the center of this interconnected system, the other principal stations being those at Miami, Miami Beach and West Palm Beach, now rated at 34,000 kw., 8,500 kw. and 5.100 kw. respectively.

Increasing Rural Profits

Owen D. Young Outlines Electricity's Part in Improving Status of American Farmer

OWEN D. YOUNG, chairman of the General Electric Company's board, addressing the American Farm Bureau Federation convention at Chicago on December 7, made a clear statement of the rural service problem as he sees it, dwelling especially on the course the farmer should follow in order to reap the utmost advantage from electric power. Mr. Young asserted that electricity will be of greater aid in the farmer's home than in his fields. The farmer, he said, must solve his own problems. The manufacturer cannot do it for him, but they can work together in formulating a unified economic program.

The electric power man, Mr. Young went on, has, like the farmer, learned the advantage of diversity in his business. This has led to the great interconnected power systems, which the farmer should unhesitatingly encourage. To oppose them means that the power companies will be confined to the cities, for it is no longer profitable to have a generating station in every community. The power companies which have extended their transmission lines through rural communities have taken on an obligation to serve the rural population in those areas. "This does not mean," the speaker said, "that they can run service to the last farm or perhaps even to the last village in that district, but it does mean that the power companies must view their obligation as having both an economic and a social aspect. The power company cannot refuse country lines because they are unprofitable. They cannot ride the economic hobby to the point where electrical service is not generally available in the community. Nor, on the other hand, can they ride the social hobby, as some visionary persons urge, to the point of financial bankruptcy. Some part of the savings from great transmission systems should be applied to the extension of farmers' service rather than be granted wholly to the cities in the diminution of their rates."

Mr. Young advocated the establishment of agricultural departments by the power companies, just as they now have industrial departments. He favored also the development of the St. Lawrence River for power and navigation, asking the farmers to support this project in their own interests, and declared for the electrification of railroads, beginning with terminals and in districts where water is falling down the same steep grades that trains are ascending. The electrical development of fertilizers, he said, needed the cooperation of power men, chemists and farmers. Muscle Shoals, for example, will produce no fertilizer until these three groups work together and the thought of political coercion is abandoned.

Electricity, Mr. Young contended in concluding his speech, cannot unfortunately supply, in the present state of the art, more than a small proportion of the forty-nine million horsepower required to run the farms of the United States. At present it supplies 4 per cent. Power for irrigation pumping and for many applications around farm buildings will add materially to this, but electricity's greatest service to the farmer will be of a social character—making his home a better place to live and lightening the housewife's burden.

Friends and Foes of Private Plants Meet

Hydro-Electric Session of Chamber of Commerce at Seattle Gives Rise to Lively Interchange of Opinion—J. B. Miller Speaks—Florence Tunnel Award

ONE session of the convention of the Western Division of the United States Chamber of Commerce held at Seattle this week was devoted to the general topic of "The Hydro-Electric Power Situation in the West." At this session R. H. Ballard read a paper by John B. Miller, president of the Southern California Edison Company, in which it was shown that out of 4,470,000 hp. installed in the generating plants serving the seven Western states, more than 90 per cent is in commercial plants and less than 10 per cent in plants municipally owned. "Our problem now is," Mr. Miller said. "which system—government-owned or corporate—will give us a unified, interconnected system, probably made up of locally owned plants but all working as a harmonious whole—which system will get the service and get it most quickly. I do not now speak of cost, for the service is far more vital than the cost.

"We look back over the entire history of government ownership in vain," Mr. Miller went on, "for any instance where any municipality and political subdivision or any state ever made one single major advance in the art of production, distribution and sale of electricity. . . . The main claim of government ownership advocates is that governments can secure capital at a lower price than can corporate utilities; therefore, that in these enterprises, where cost of capital is all-important, government can give lower prices for services. This claim is true only in a very narrow sense. In America the differential between cost of capital to a municipality and cost of capital to a sound corporation is today principally taxes. This is no saving at all.

"I have said that service is the all-important thing, and so it is if we consider business alone. When we come to consider the reaction on government itself, we find a factor of such importance that it puts both cost and service into the background. This cannot be too highly emphasized. I refer to the domination of government by its nominal creature—to the building up of a bureaucracy thereafter, controlling the sources of public information, presenting its propaganda unopposed, marshaling its subordinates into a political machine, controlling elections and, virtually, though sometimes surreptitiously, abolishing democracy."

MEDALLION COMMEMORATING COMPLETION OF FLORENCE LAKE TUNNEL

The Seattle meeting was the theater of an animated debate between the advocates of municipal plants and the friends of private ownership and operation. It was attended by four hundred business officials from eleven Western states, Alaska Hawaii and the Philippines.

Other speakers for the privately owned plants were O. B. Coldwell, vice-president Portland Electric Power Company, and Norwood W. Brockett, director of public relations for the Puget Sound Power & Light Company. The progress of municipally operated plants on the Pacific Coast was recounted by Superintendent J. D Ross of Seattle and County Councilman Ralph Criswell of Los Angeles. Mr. Ross and Mr Brockett debated the Skagit development. Mr. Criswell's claims for the Los Angeles municipal plant were shown to take no account of the fact that none of the cost of the 234-mile aqueduct had been charged against the power plant, but all to the water system.

George Clinton Ward, vice-president in charge of construction of the Southern California Edison Company, and his associates were honored by the presentation of a bronze medallion mounted on the last piece of granite blasted from the Florence Lake Tunnel. Paul Shoup, vice-president of the Southern Pacific Railroad and also of the Chamber of Commerce, made the presentation, reciting the achievement of Mr. Ward and his associates in building the world-famous tunnel. The medallion bears the inscription, "By their works ye shall know them."

Engineers Hear of Relation of Industry to Defense

The American Institute of Electrical Engineers held a joint meeting with the other major engineering societies in New York on December 4 to give support to the War Department's program for industrial mobilization. Judge E. H. Gary, chairman of the board of the United States Steel Corporation, presided as chairman of the advisory board of the New York Ordnance District, and the meeting was addressed by Secretary of War Davis, Assistant Secretary of War MacNider, General James G. Harbord, General Charles B. Summerall and Colonel Frank A. Scott. A number of distinguished leaders of American industry were on the platform.

Tri-State Colorado Pact

California and Nevada Take Draft of One to Arizona Committee—New Boulder Canyon Dam Bill

AIMING to have the states of the Southwest present a solid front at Washington when the question of the development of the Colorado River is brought up, representatives of California and Nevada on December 1 went to Phoenix and laid before Governor Hunt's Arizona Colorado River Committee a draft of a proposed tri-state agreement. This agreement is designed to serve as a supplement to the Colorado River compact formed at Santa Fe, N. M., in 1922, which six of the seven Colorado River states approved, Arizona alone refusing to sign. Representatives of California and Nevada drew up and agreed upon the terms of the tri-state agreement at a conference in Los Angeles on November 30. Concessions and guarantees are made intended to assure to Arizona an ample supply of water and power derived from the river to enable that state to develop its own resources to their full capacity. A provision whereby Arizona is to receive what it is estimated will amount to $500,000 a year from power developments at Boulder Canyon was expected to have considerable influence in the shaping of Arizona's attitude toward the agreement.

The plan has been taken under consideration by Governor Hunt and his representatives, who have intimated that they will be prepared to submit a counter proposition at another meeting. It is intended that this proposal will set forth clearly the conditions under which Arizona would feel justified in entering into any agreement concerning the Colorado River. Approximately ten days will be required to shape this proposal, according to C. W. Van Dyke, chairman of the Arizona committee, which tentatively sets the date for the next conference at about December 15.

Briefly summarized, the tri-state agreement as proposed by California and Nevada provides:

1. All water contributed by Arizona rivers to be used solely by Arizona—approximately 1,000,000 acre-feet.

2. Water which is now being used by the states is definitely allocated to the present users. Rights to this water are not in any way affected by the present proposal.

3. A total of 1,095,000 acre-feet allocated to California. This is the equivalent of the 1,500 sec.-ft. which has been filed upon by California municipalities for domestic water.

4. A total of 300,000 acre-feet allocated to Nevada in addition to the entire output of the Virgin River.

5. All remaining water to be divided equally between California and Arizona, with a provision that any of this water which is not in beneficial use by 1975 shall be available for definite allocation to either California or Arizona. This is to protect Arizona in case California should develop a "beneficial use" for the water more rapidly than Arizona.

6. Arizona and Nevada are to be paid one dollar per horsepower of electrical energy developed at Boulder Canyon. It is estimated that this will amount to $1,000,000 a year, $500,000 to each state.

All advocates of the Boulder Canyon Dam are not, however, bent on conciliating Arizona, and word comes from Washington that the new Swing-Johnson bill providing for the construction of the dam will contain a clause granting congressional approval to a six-state treaty for the division of the waters of the Colorado, Arizona being left out of the reckoning. Hearings on this bill have begun before the Senate committee on irrigation and reclamation, O. C. Merrill being the first witness.

President Would Dispose of Muscle Shoals

Thinks Its Importance Exaggerated and Wants Committee of Congress to Receive Bids and Make Recommendations —Deals with Colorado Problem

PRESIDENT COOLIDGE'S message to Congress, submitted on Tuesday of the present week, dealt with several subjects of especial concern to the electrical industry. He expressed himself as in favor of disposing of the government's property at Muscle Shoals to serve defensive, agricultural and industrial purposes, but refrained from any detailed discussion of the many points involved in such a transfer; he advocated that Congress set up some agency to deal with Colorado River development upon the basis of economic and engineering facts, and he alluded briefly to water power in its national aspect. Defining the proper function of the Federal Trade Commission as "to supervise and correct those practices in commerce which are detrimental to fair competition," he held that it should be "continued and supported." He again declared for the reorganization of the executive departments of the government.

Extracts from the President's message follow:

MUSCLE SHOALS

"The problem of Muscle Shoals seems to me to have assumed a place all out of proportion with its real importance. It probably does not represent in market value much more than a first-class battleship, yet it has been discussed in the Congress over a period of years and for months at a time. It ought to be developed for the production of nitrate primarily, and incidentally for power purposes. This would serve defensive, agricultural and industrial purposes. I am in favor of disposing of this property to meet these purposes. The findings of the special commission will be transmitted to the Congress for their information. I am convinced that the best possible disposition can be made by direct authorization of the Congress. As a means of negotiation I recommend the immediate appointment of a small joint special committee chosen from the appropriate general standing committees of the House and Senate to receive bids, which when made should be reported with recommendations as to acceptance, upon which a law should be enacted effecting a sale to the highest bidder who will agree to carry out these purposes.

"If anything were needed to demonstrate the almost utter incapacity of the national government to deal directly with an industrial and commercial problem, it has been provided by our experience with this property. We have expended vast fortunes, we have taxed everybody, but we are unable to secure results which benefit anybody. This property ought to be transferred to private management under conditions which will dedicate it to the public purpose for which it was conceived."

COLORADO RIVER

"Preliminary measures are being taken on the Colorado River project, which is exceedingly important for flood control, irrigation, power development and water supply to the area concerned. It would seem to be very doubtful, however, whether it is practical to secure affirmative action of the Congress, except under a joint agreement of the several states.

"The government has already expended large sums upon scientific research and engineering investigation in promotion of this Colorado River project. The actual progress has been retarded for many years by differences among the seven states in the basin over their relative water rights and among different groups as to methods. In an attempt to settle the primary difficulty of the water rights, Congress authorized the Colorado River Commission, which agreed on November 24, 1922, upon an interstate compact to settle these rights, subject to the ratification of the state legislatures and Congress. All seven states except Arizona at one time ratified, the Arizona Legislature making certain reservations which failed to meet the approval of the Governor. Subsequently an attempt was made to establish the compact upon a six-state basis, but in this case California imposed reservations. There appears to be no division of opinion upon the major principles of the compact, but difficulty in separating contentions as to methods of development from the discussion of it. It is imperative that flood control be undertaken for California and Arizona, preparation made for irrigation, for power and for domestic water.

"Some or all of these questions are combined in every proposed development. The federal government is interested in some of these phases, state governments and municipalities and irrigation districts in others, and private corporations in still others. Because of all this difference of view it is most desirable that Congress should consider the creation of some agency that will be able to determine methods of improvement solely upon economic and engineering facts, that would be authorized to negotiate and settle, subject to the approval of Congress, the participation, rights and obligations of each group in any particular works. Only by some such method can early construction be secured."

Torchio Tells of Big Cable

Empire State Men Hear Plans of New York Edison and Discuss Many Practical Reports

THE Electric Section of the Empire State Gas and Electric Association held its annual meeting on December 4 and 5 in the New York Edison Company's auditorium in the Twenty-seventh Street substation. Philip Torchio of that company, who welcomed the delegates in place of Vice-president Lieb, adverted to many of the projects now in construction or contemplation by it and particularly to the 132-kv. cable which will run up into Westchester County and will ultimately serve as an interconnection between the New York company and systems in the upper part of the state. This cable will have a capacity of 90,000 kva.

The transmission lines committee report, read by its chairman, T. A. Bacon, was concerned with the study of a possible 220-kv. trunk-line transmission system for New York State, contemplating the utilization of surplus power from international developments on the St. Lawrence River, from other Canadian developments and from the Adirondack regions. Exclusive of Niagara Falls, it was assumed in the report that these water powers represent a surplus of nearly 2,000,000 kva. With the normal increase in the local use of electrical energy near the power sites, it is predicted that in 1935 this surplus will have been reduced to 1,800,000 kva., and it is this remaining surplus which the plan contemplates utilizing between now and 1935. The plan allots 1,000,000 kw. to the metropolitan district and to the industrial districts of New Jersey and eastern Pennsylvania and 500,000 kw. to the industrial districts of New England.

In the absence of W. F. Hudson, chairman of the electric apparatus committee, its report was submitted by Sidney Alling of the Rochester Gas & Electric Corporation. In discussing it, R. J. Wensley of the Westinghouse Electric & Manufacturing Company spoke on supervisory control of automatic substations, referring also to the control of transmission-line operations now in use by the Alabama Power Company, by which through a carrier-current system it is possible to sectionalize 15-mile portions of the line. H. G. Rice of the General Electric Company talked on mechanical improvements in alternating-current machinery, describing welded-steel frames for large rotating apparatus in place of cast frames. E. K. Huntington of the Rochester Gas & Electric Corporation described a home-made supervisory system, costing only $500, now in use by the Rochester company to cover the operations of a number of outlying substations, which performed its functions admirably.

In the afternoon A. C. Jordan of the Elmira Water, Light & Railroad Company, speaking for the radio committee, related how many instances of radio interference had been taken care of by his company. The operation committee presented two papers. The first, on the interconnected transmission systems in New York State, was by G. A. Powell of the Adirondack Power & Light Corporation. Mr. Powell referred to saving in investment for equipment and to reliability of service. The point was brought up that although an interconnected system offers to a consumer the entire resources of many plants, at the same time it imposes on that consumer the troubles which naturally arise in any large system. The second paper, by Chairman J. C. Robbins, proposed fundamental rules, digested from the practice of many companies, for the protection of men working on high-tension circuits and equipment.

In an address on "Our Common Task," Howard B. Sands, vice-president of C. H. Tenney & Company and also of the National Electric Light Association, made it clear that the common task of all persons connected with a public utility was service to the public, which included the duty of convincing the public of the sincerity of the utility.

On Saturday morning the report of the underground system committee, of which R. A. Paine of the Brooklyn Edison Company is chairman, was presented. The 132-kv. cable referred to by Mr. Torchio was described by C. W. Franklin of the United Electric Light & Power Company. Mr. Pilkington of the Brooklyn Edison Company analyzed the virtues of single-conductor as against multiple-conductor underground cables. The report of the overhead distribution committee was read by Sidney Alling and was followed by a paper on rural distribution by means of single-conductor cables, by Mr. Underhill of the Niagara, Lockport & Ontario Power Company.

R. A. Paine, Jr., of the Brooklyn Edison Company was elected chairman of the section and T. A. Bacon of the Adirondack Power & Light Corporation vice-chairman for the ensuing year.

Industrial Lighting Competition Prizes and Judges

Prizes of $2,500, $1,500 and $1,000 respectively will be awarded next spring by the industrial lighting committee of the National Electric Light Association to the three electrical leagues or electric service companies which in the opinion of the committee shall have done the best work along the lines the committee is promoting. These prizes will be for the period from September 1, 1925, to March 1, 1926, and reports must be in the offices of the committee at New York headquarters by April 1 next. The names of the prize winners will be announced at the N. E. L. A. convention in Atlantic City.

Five judges have been selected. They are: Earl E. Whitehorne, chairman, commercial editor of the ELECTRICAL WORLD; James E. Davidson, president of the N. E. L. A. and vice-president of the Nebraska Power Company, Omaha; Edward W. Lloyd, chairman Commercial Section, N. E. L. A., and general contract agent Commonwealth Edison Company, Chicago; Dugald Jackson, professor of electrical engineering, Massachusetts Institute of Technology, and Merritt Lum, vice-president A. W. Shaw Company of Chicago, publisher of *Factory*.

Power and Preparedness

Chief Engineer Taylor of Army Tells Congress Scope and Object of Electric Plant Survey

IN HIS annual report to Congress the Chief of Engineers reports on the survey which the army is making of the power resources in industrial areas. On that subject General Taylor says:

"A survey of the electric power plants and resources of the United States was commenced during the fiscal year 1922, under authority of the national defense act of June 4, 1920. It was desired by this means to obtain information and to develop plans which would enable the nation to utilize to the utmost all available electric power in time of war and to assure the fairest and most efficient distribution to industries which would be engaged in work essential to the prosecution of hostilities. During the World War the government established a measure of control over electric power, as described in War Department Document No. 1039, 'The Power Situation During the War.' The present survey is based upon and is planned in furtherance of the lessons therein set forth.

"During the past year matters in this office pertaining to this survey have been handled in the office of the resident member of the Board of Engineers for Rivers and Harbors. The objects of the survey are to collect data on existing power companies of over 5,000 kw. capacity, to establish contact with the principal men in the power-production business, to seek the co-operation of producers in so planning their extensions and new developments as best to meet war-time needs, to ascertain the possibilities of increased power development in combination with navigation improvement, flood control or otherwise, and to ascertain the best system for the government to adopt for developing power resources and for administering power distribution in a national emergency. Especial emphasis is being laid on close co-operation with the large power producers and interests, as it is realized that only in this manner can a successful system be devised. Duplication of work done by other government bureaus is being avoided, and every effort is made to utilize existing data. The study is being conducted by personal conferences and correspondence with power producers at slight cost.

"An initial survey of the situation for the entire continental United States has been completed, and a report based thereon was during the year transmitted to and approved by the Assistant Secretary of War. The plan contained in this report contemplates the division of the country for peace-time investigation and war-time administration into eleven territorial power zones. During peace time the necessary work and investigation in each power zone will be under a division or district engineer stationed therein. Annual reports will be submitted by these, and based thereon, the Chief of Engineers will transmit annually to the Assistant Secretary a project, revised up to date, for co-ordination in emergencies."

Briefer News

Rocky Mountain Section Conference Postponed.—The section and committee conference of the Rocky Mountain Section, N. E. L. A., which was announced last week for December 14 and 15, has been postponed to January 25 and 26. It will, as stated, be held at Idaho Springs, Col.

Wisconsin Railway, Light & Power Becomes Mississippi Valley Public Service.—The name of the Wisconsin Railway, Light & Power Company, which does a light and power business much larger than its railway business, has been changed and the company will hereafter be known as the Mississippi Valley Public Service Company.

Readjustment at Lincoln, Neb.—The Continental Gas & Electric Corporation, a United Light & Power subsidiary, has asked the Nebraska State Railway Commission for authority to sell to the Lincoln Public Service Company, organized with a capitalization of $6,500,000, the lighting and gas plant of the Lincoln Gas & Electric Light Company and the lighting plant of the Lincoln Traction Company, both of which it recently purchased.

Bristol (Va.-Tenn.) Plant to Be Enlarged. — Additional generating and auxiliary equipment has become necessary at Bristol, on the Virginia-Tennessee border, and the Cities Service Company, the controlling organization for the local plant, will expend $500,000 there within the next few months to enlarge the station, providing 1,275 kw. additional. Remote automatic control will be used. The company spent $150,000 early in the year in improvements.

Hydro-Electric Development in Manitoba.—It is reported that the contract signed by the Manitoba Power Company with the Spanish River pulp and paper interests to supply their new Manitoba paper mill requires immediate installation of another unit of 28,000 hp. in addition to the 56,000 hp. now in operation. When the new unit is completed another of the same size will be started, which, when completed, will give the plant a total developed horsepower of 112,000.

San Joaquin Company's 1926 Budget Exceeds $12,000,000.—An operating and construction budget for 1926 amounting to $12,372,000 has been approved for the San Joaquin Light & Power Corporation, Fresno, Cal., according to A. Emory Wishon, general manager. The largest single item in the budget is $2,789,000 for construction work on the Kings River hydro-electric development, work on which is now under way. The first power house to be built in this development will, as already announced, be known as the Balch plant and have an initial capacity of 33,000 kva. Double overhung impulse waterwheels will operate under an effective head of 2,400 ft. The work will cost about $5,000,000 and the plant is scheduled for completion by January, 1927.

Princeton to Build Engineering Laboratory.—Plans have been prepared for a new engineering laboratory which is to be erected for the School of Engineering of Princeton University in the next two years at a cost of $500,000. The new building will accommodate 400 students, the number to which the Engineering School is limited, and will be equipped for all kinds of scientific research, including provisions for electrical testing.

Christmas Broadcasting from General Electric Station.—Under the title "The Spirit of Light," S. W. Ashe of the General Electric Company's educational department broadcasted from station WGY at Schenectady on Friday evening, December 11, a Christmas talk which was accompanied by operatic and other musical selections appropriate to the season. The importance and beauty of light and the symbolism of color were expressed in an easily comprehended form with interesting historic references.

New Jersey Power & Light Acquires More Plants.—By the purchase of the Eastern Pennsylvania Power Company from the Pennsylvania Edison Company the New Jersey Power & Light Company will extend its system to the Delaware River at a point opposite Easton, Pa. The two systems are already interconnected. The New Jersey Power & Light has also just purchased the distribution system of the Raritan Valley Hydro-Electric Company, which will be tied in at Flemington and a small hydro-electric plant discontinued.

Yolo (Cal.) Water & Power Company Will Be Sold to Highest Bidder.—A receiver has been named for the Yolo Water & Power Company, in central California, as a result of a suit to foreclose a mortgage lien brought against the corporation by the Oakland Bank. Approximately $9,900,000 in bonds and $3,712,500 in interest is involved. G. H. Hoppin is the receiver, and it is reported that he will take possession at once and will operate the property until it can be sold to the highest bidder in the open market.

Wisconsin Traction, Light, Heat & Power Wins Right to Supply Clintonville.—Construction of the Wisconsin Traction, Light, Heat & Power Company's transmission line between Appleton and Clintonville, which was halted by injunction proceedings instituted by the Central Wisconsin Power Company of Oshkosh, on the claim of invasion of territory, will be resumed again, the injunction having been dissolved. The line from Appleton will supply energy to the Clintonville municipal electric plant for redistribution.

Interconnection Plans of Lake Superior District Power Company.—The Lake Superior District Power Company of Ashland, Wis., and Ironwood, Mich., a subsidiary of the Middle West Utilities Company, announces that it will begin early in January to connect its Medford (Wis.) plant with its Big Falls hydro plant through the construction of a 33,000-volt, 63-mile transmission line at a cost of $115,000. Isolated plants at Glen Flora, Hawkins, Catawba, Kennan and a score of other places in Wisconsin will thus be brought on the company's lines.

Contemplated Railroad Electrification in North Carolina.—The Norfolk Southern Railroad, which runs from Norfolk, Va., to Charlotte, N. C., through Raleigh, and has 800 miles of trackage, has recently been sold and, according to what the local press calls "dependable authority," is now under the control of the Duke interests, which are said to contemplate connecting it with their Piedmont & Northern electric road in North Carolina and eventually electrifying the whole system, with extensions.

Application for Water from Klamath River Withdrawn.—Threatened opposition by the California Fish and Game Commission was given by Thomas M. Park of San Francisco as the reason for the withdrawal of his application to the state Division of Water Rights to appropriate 3,000 sec.-ft. of water from the Klamath River in northern California for the operation of a large hydro-electric plant. Although he has withdrawn his application, Mr. Park says that he does not intend to abandon his ten-million-dollar project. This proposed development was mentioned in the ELECTRICAL WORLD for October 31, page 918.

Electricity for Irrigation Pumping Takes Strides in Rio Grande Valley.—Expansion of the electric power transmission system of the Valley Electric & Ice Company of San Benito, Tex., is bringing about a rapid transformation in the use of power by the large pumping plants of the forty irrigation systems in the lower Rio Grande Valley. Following the recent announcement that the Donna Irrigation District had decided to install electric motors in its pumping plant, steps were taken by a number of other irrigation districts to change from steam to electric power. Heretofore all of the Valley pumping plants have been driven by internal-combustion engines. Engineers' estimates show that a change to electricity will mean a great saving to the farmers.

St. Lawrence Development Up Again in Canadian Parliament.—The development of the St. Lawrence River is the subject of two motions which have been placed on the order paper of the Canadian House of Commons. The first motion advocates a treaty between Canada and the United States for the purpose of immediate development and generation of power on the St. Lawrence. The second motion recommends that the government of Ontario and the Hydro-Electric Power Commission of that province be given leave to develop power at the Morrisburg dam and to use an increased flow of water power from the Niagara River. In a survey of the power potentialities of the international reaches of the St. Lawrence River before a gathering of engineers, Arthur V. White, consulting engineer of the Hydro-Electric Power Commission, said that there was a possible

development of 4,000,000 hp. by three dams, the first to supply 800,000 hp. each for Canada and the United States, and two plants lower down, entirely in Canada, to supply the remainder.

Oswego Central-Station Company May Go to Carlisle Interests.—The dispute over electric light and power service in Oswego, N. Y., reported in the ELECTRICAL WORLD for October 24 (page 869), is likely to be adjusted, subject to commission approval, through the purchase by F. L. Carlisle & Company for the General Development Company of the People's Gas & Electric Company, at present controlled by Charles H. Tenney & Company of Boston. The Carlisle interests have a hydro-electric plant of 22,000 hp. under construction in the Oswego district. It is planned ultimately to link the People's Gas property with the transmission system of Power Corporation of New York.

Rochester Gas & Electric Plans Hydro-Electric Development at Canadea.—Erection of a two-million-dollar power dam and plant at Canadea, N. Y., 60 miles southwest of Rochester, to regulate the flow of the Genesee River and provide additional power is planned by the Rochester Gas & Electric Corporation, through a subsidiary company, the Canadea Power Company. Eight hundred acres of land has been purchased, and work is to start on the project in the spring. The hamlet of East Rushford will be wiped out by the building of the dam. This project will delay for at least two years construction of the proposed power dam at Mount Morris in the Genesee River Valley, estimated to cost $11,000,000.

Holyoke (Mass.) Water Power Company Gains Large Territory.—A new corporation called the Holyoke Power & Electric Company has been formed with a Massachusetts charter by the Holyoke Water Power Company group. It is capitalized at $1,000,000, and the purpose named is that of making and distributing electricity within the commonwealth. Joseph A. Skinner, vice-president, explained that the Holyoke Water Power Company is limited in its field of operations to the city of Holyoke. Under the new charter this field will be broadened and opportunities afforded to use energy that is now going to waste. There are no plans for immediate expansion, he said, and he knew of no proposal to merge the company with other New England electrical concerns. Robert E. Barrett will be president and treasurer of the new company.

Helping Out a Municipal Plant.—When the drive shaft of an engine at the Miami (Okla.) municipal power plant broke and it became evident that it would require from thirty to forty days to repair the damage, J. E. Harsh of Joplin, Mo., 30 miles away, general manager of the Empire District Electric Company, agreed to furnish temporary service without a franchise. Crews were summoned from near and far to the number of seventy-five men, two spare transformers were located and loaded with the other necessary equipment on a train for Miami, being prepared for installation while the train was in motion, and 5½ miles of high-voltage transmission line from the company's substation at Commerce as well as a new substation were erected, all this being accomplished within seventy-two hours.

Los Angeles Completes New Substations.—The substantial completion of seven new substations for the Bureau of Power and Light of Los Angeles is reported by Chief Electrical Engineer E. F. Scattergood. Construction work on these stations began last summer and has been carried to completion in the shortest possible time. The substations mentioned in the report are the Longwood station, at San Vicente and Longwood Avenues, in the district surrounding Los Angeles High School; a station in the Hyde Park district, a station in Sawtelle, a station at Ninety-first Street and Menlo Avenue and three stations in the San Fernando Valley at Owensmouth, Reseda and Lankershim.

Absorption of Wisconsin's Small Plants.—The year 1925 is witnessing the absorption of a larger number of private and municipal electric plants by the Wisconsin Power & Light Company than any other year since the company's organization. Since the first of the year it has taken over twenty-two local electric service companies in the southern and central parts of the state. The latest acquisition is the Clearwater Electric Company, and the next plant to be taken over will probably be the Merrimac Electric Light Company. The company's program provides for the acquisition of sixteen more electric plants before the end of the year.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

American Physical Society — Kansas City, Dec. 28-30. H. W. Webb, Columbia University, New York.

Northwest Association of Electrical Inspectors—Multnomah Hotel, Portland, Ore., Jan. 11-12. F. D. Weber, 401 Lumbermen's Bldg., Portland.

Kentucky Association of Public Utilities—Brown Hotel, Louisville, Jan. 15. E. F. Kelley, Louisville Railway Co., Louisville.

Rocky Mountain Section, N. E. L. A.—Hot Springs Hotel, Idaho Springs, Col., Jan. 25-26. O. A. Weller, Public Service Company of Colorado, Denver.

Western Association of Electrical Inspectors—Hotel Sherman, Chicago, Jan. 26-28. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—New York, Feb. 8-12. F. L. Hutchinson, 33 West 39th St., New York.

Southwestern Public Service Association—Galveston, Tex., April 13-16. E. N. Willis, 403 Slaughter Bldg., Dallas.

Southwestern Geographic Division, N. E. L. A.—Galveston, Tex., April 13-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio.

National Electric Light Association—Atlantic City, N. J., May 17-21. M. H. Aylesworth, 29 West 39th St., New York.

Gould Interests of Chicago May Buy Maine Properties.—Negotiations are in progress between the Pierce Engineering Company, Chicago, and the Gould interests for the tentative sale of the Maine & New Brunswick Electric Power Company and the Gould Electric Company, Presque Isle, Me., to the Pierce interests. No definite announcement of the result of these negotiations is expected before December 15, according to a statement this week of A. R. Gould to a representative of the ELECTRICAL WORLD.

Pennsylvania Legislature Not Yet Called.—An announcement received by the ELECTRICAL WORLD as it went to press last week to the effect that Governor Pinchot had called a special session of the Pennsylvania Legislature to deal with the coal strike, "giant power" and other matters proved to have been premature. There is, however, apparently little doubt that such a session will be called in the near future.

Audit of New Brunswick's Power Commission Finance Attacked.—The audit of the books of the New Brunswick Electric Power Commission recently issued by the commission, which was summarized in the ELECTRICAL WORLD for December 5 (page 1167), has been attacked by Dr. P. J. Veniot, former Premier and chairman of the Power Commission, who declares that the figures given to show the operating deficit are misleading. Dr. Veniot maintains that the actual cash deficit in the ten-month period covered was only $1,815.

Portland (Ore.) Companies to Have New Office Building.—A new building to house the general offices of the Pacific Power & Light Company, the Northwestern Electric Company and the Portland Gas & Coke Company, Portland, Ore., will rise within the next two years on the block bounded by Fifth, Taylor, Sixth and Salmon Streets. Initial plans call for a twelve-story steel and concrete building, to cost $1,000,000, on the northwest quarter of the block and two stories of a building ultimately to be twelve stories high on the southwest quarter.

Metropolitan Section, N. E. L. A., Hears National Officers and Aids National Work.—Before an attendance of more than four hundred members of the Metropolitan Section of the N. E. L. A. in New York on December 3, President J. E. Davidson of the national body urged that all electric service companies further the use of electricity by carrying on extensive merchandising of electric appliances. He pointed out the necessity of doing this in order to aid the growth of the industry and also to give the public the service it deserves. Managing Director M. H. Aylesworth also addressed the members. A. W. Root, chairman of the Metropolitan Section, said in opening the meeting that there were now more than fifteen hundred members in the section and that 20 per cent of them were engaged in active committee work which was providing valuable material for the national association.

Men of the Industry

J. R. Cravath Establishes Offices in San Francisco

James R. Cravath, for ten years Western editor of the ELECTRICAL WORLD at Chicago, has opened an office in the Call Building, San Francisco, as a consulting electrical and illuminating engineer. For some years after he had resigned from the ELECTRICAL WORLD Mr. Cravath was associated with Frank F. Fowle, also a former ELECTRICAL WORLD man, in the firm of Fowle & Cravath, consulting engineers of Chicago. Owing to the ill health of one of the members of his family, Mr. Cravath moved to California in 1920 and soon thereafter formed the Pioneer Electric Company of Richmond, Cal., of which he became president. Although still retaining an interest in this company, Mr. Cravath has left most of the active management to his associates, thus enabling him to devote more time to consulting work. He is conversant with all details of public utility work, having owned and managed a number of small utility companies in the Middle West, and is a co-author with Van R. Lansingh of a book entitled "Practical Illumination."

H. Erickson Heads Wisconsin Service Corporation

Halford Erickson, vice-president in charge of operation of H, M. Byllesby & Company, Chicago, was chosen president of the Wisconsin Public Service Corporation at a meeting of the board of directors on December 1 in Milwaukee, the first election to select permanent officers since the corporation passed into the hands of the Byllesby interests. Clement C. Smith, formerly president of the corporation, was elected chairman of the board, a newly created position. J. P. Pulliam will remain in his old office as vice-president and general manager and C. R. Phenicie at Green Bay as vice-president. Other officers elected were: Vice-presidents, Robert J. Graf, Chicago, first vice-president of the Byllesby company, and H. C. MacKay, Milwaukee, formerly secretary-treasurer of the corporation; secretary, M. A. Morrison, Chicago; treasurer, C. E. Kohlhepp, Milwaukee, formerly in charge of the corporation's auditing department. The following were elected directors: Clement C. Smith, R. J. Graf, H. Erickson, J. J. O'Brien and J. P. Pulliam. Mr. Smith announced that the Byllesby company had been so well pleased with the management of the affairs of the Wisconsin Public Service Corporation that it had determined to leave the local organization intact—a departure from the policy usually followed.

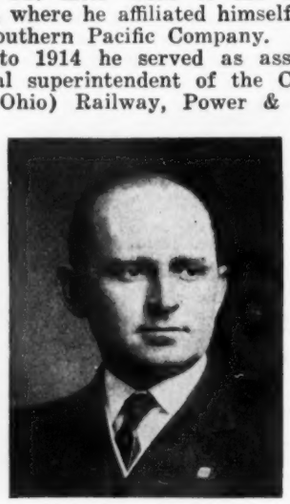
A. H. Smith, chief engineer of the Nova Scotia Power Commission, has resigned from office and **Harold S. Johnson**, hydraulic engineer on the staff of the Power Commission for several years, has been promoted to fill the vacancy. **J. Lumdsen**, electrical engineer on the Power Commission staff, has been promoted to the office of assistant chief engineer.

B. C. Edgar and J. P. W. Brown of Nashville Receive Promotions

B. C. Edgar, vice-president and general manager of the Nashville (Tenn.) Railway & Light Company, has been elected president of the organization, and J. P. W. Brown, formerly general

B. C. EDGAR

superintendent, has been elected vice-president and general manager to succeed Mr. Edgar. The new president was born in Rahway, N. J., and was graduated from Rutgers College, New Brunswick, N. J., in 1900 in electrical engineering. Since that time he has been continuously identified with the electrical industry. At first he engaged in railway electrification in the East, but later went to the Pacific Coast, where he affiliated himself with the Southern Pacific Company. From 1912 to 1914 he served as assistant general superintendent of the Columbus (Ohio) Railway, Power & Light



J. P. W. BROWN

Company, relinquishing the duties of that office to become general superintendent of the Nashville Railway & Light Company. It was in February, 1919, that Mr. Edgar was promoted to the vice-presidency of the Chattanooga Railway & Light Company, the Nashville Railway & Light Company and the Tennessee Electric Power Company.

Mr. Brown became identified with the electrical industry in Nashville twenty-seven years ago, when he supervised the inspection of installations of all electric lighting, power and scenic effects at the Tennessee Centennial Exposition immediately upon the completion of his work at Vanderbilt University. He entered the employ of the Cumberland Electric Light & Power Company as switchboard operator in 1898, and two years later, when the Cumberland company was merged with the railway and became the Nashville Railway & Light Company, Mr. Brown was made superintendent of the lighting and power departments of the new company. In the spring of 1917 Mr. Brown was promoted to the office of assistant general superintendent over the entire local railway and light property, and five years ago he succeeded B. C. Edgar as general superintendent of the company. Last January Mr. Brown was honored by citizens of Nashville at a meeting in the Chamber of Commerce and proclaimed the city's "most valuable citizen."

T. A. Kenney of New York was elected vice-president and B. F. Manning secretary-treasurer. Mr. Kenney succeeded G. L. Estabrook upon his retirement from the board of directors, and Mr. Manning was selected to succeed Mr. Estabrook as secretary and treasurer.

Manfred K. Toeppen has resigned from the position of chief engineer of the Michigan Public Utilities Commission and has opened offices in Detroit, where he will engage in consulting engineering.

J. D. Shaw, formerly connected with the Western Public Service Company at Liberty, Tex., is now affiliated with the Lake Charles (La.) properties of Stone & Webster, Inc., in the capacity of superintendent of construction. Mr. Shaw will have active charge of all work in connection with the company's new transmission system.

Jean Boyau has been appointed resident engineer of the Compagnie Française Thomson-Houston with offices in the International General Electric Company's quarters at Schenectady. He succeeds Jean Canivet, who was accidentally drowned July 10. Mr. Boyau studied at the Lycée Carnot in Paris. After demobilization from the French army he entered the employ of the French Thomson-Houston company in Paris and came to the United States in May of this year as assistant to Mr. Canivet.

C. J. Green, chief engineer of the Public Service Commission of Oregon, has been appointed assistant chief accountant-engineer of the Federal Power Commission, Washington, D. C. Mr. Green has been affiliated with the Oregon Public Service Commission since 1913, engaging in analyzing inventories and appraising hydro-electric properties before his appointment as chief engineer. Following the completion of his education at the University of Michigan and the University of Oregon, he spent some time in irrigation and railroad

construction and in the employ of the Mount Hood Railway & Power Company and the Portland Railway, Light & Power Company. It is expected that Mr. Green will spend much of his time on the Pacific Coast in connection with administering federal regulations affecting hydro-electric properties.

J. B. Hayes and **P. M. Wentworth**, who have been managers of the Stone & Webster properties in Fort Madison and Keokuk, Iowa, have been transferred to other cities as the result of the disposal of the Fort Madison interests of Stone & Webster to the Union Electric Light & Power Company of St. Louis. Mr. Hayes will join the Virginia Electric & Power Company at Richmond, Va., as manager, which position he held in Fort Madison. Mr. Wentworth, manager in Keokuk of the Stone & Webster properties, has gone to Haverhill, Mass.

R. W. Spofford, general manager of the Manila Electric Corporation, Manila, P. I., for the past six years, has returned to the United States to become manager of railways for the Monongahela West Penn Public Service Company, with headquarters at Fairmont, W. Va. Mr. Spofford was graduated from the United States Naval Academy at Annapolis and spent about five years in the navy, retiring in 1911. Soon after he joined the J. G. White Management Corporation and was assigned to the engineering staff of the Augusta-Aiken Railway & Electric Corporation, Augusta, Ga., of which utility he later became general manager.

A. Kristian Bak, technical engineer at the Trenton Channel plant of the District Edison Company, is returning to Copenhagen, Denmark, after a stay of six years in the United States. Mr. Bak will engage in efficiency engineering in the municipal power organization, which has recently begun the construction of a new plant. Part of his duties will include the introduction of American methods of power-plant operation. The recipient of a fellowship from the American-Scandinavian Foundation of New York, Mr. Bak spent one term at the Massachusetts Institute of Technology as instructor and student in mechanical engineering, and the following half year he attended the Sheffield Scientific School at Yale. Mr. Bak's duties with the Detroit utility started at Connors Creek in 1920.

Walter P. Schwabe, who has been vice-president and general manager of the Northern Connecticut Light & Power Company, has been elevated to the post of president of the company. He retains the duties of general manager. Mr. Schwabe joined the company seventeen years ago as superintendent and seven years later was advanced to the vice-presidency and made general manager. Under his direction the business has made a remarkable growth. For some time past Mr. Schwabe has been president of the Thompsonville Water Company and the Stafford Springs Aqueduct Company, which, with other similar properties in the vicinity, have been sold to the J. G. White Engineering Company, Inc., of New York, now in control of the Northern Connecticut Light & Power.

W. E. Brown Heads General Electric Central-Station Department

W. E. Brown, who has been appointed district manager of the central-station department, New York district, of the General Electric Company, entered the employ of the company in December, 1899, following his graduation from Union College, Schenectady, in the electrical engineering course. After three years in the test course, Mr. Brown entered the industrial engineering department and from there went to the industrial commercial department.

On May 1, 1907, Mr. Brown was appointed manager of the Schenectady local office of the New York district, which position he held until his recent appointment in the central-station department. Mr. Brown's offices are now at 120 Broadway, New York City. C. B. Keyes has been appointed district manager of the railway department with offices in New York City. These two appointments follow the recent retirement of S. W. Trawick from the office of manager of the central-station and

W. E. BROWN

railway departments of the New York district after thirty-seven years of service in the electrical industry. Mr. Trawick was formerly associated with the Excelsior Electric Company of Chicago, the Westinghouse Electric & Manufacturing Company and the Brush Electric Company at Atlanta, entering the employ of the General Electric Company at Atlanta in 1894. On September 1, 1903, he joined the railway department in New York, with which he has ever since been associated.

C. I. Crippen has resigned as assistant to the vice-president and general manager of the Pennsylvania-Ohio Electric Company to become operating manager of Stevens & Wood, Inc., with headquarters in New York City, having charge of the operation of the public utilities managed by that organization. Mr. Crippen has been prominent in electric utility work and as a consulting engineer in Youngstown and vicinity for a period of about seventeen years. Previous to his becoming assistant to the vice-president and general manager of the Pennsylvania-Ohio Electric Company, he was district manager for Dwight P. Robinson, with headquarters at Youngstown, Ohio. Formerly he was senior partner in the firm of Crippen & Funk, Youngstown, Ohio, and previous to that connection was manager of the power sales department of the Pennsylvania-Ohio Power & Light Company.

I. H. Watson, manager of the gas department of the Madison County Power & Light Company, has been made district manager of all of the utilities of the Illinois Power & Light Corporation in the Edwardsville (Ill.) district.

Obituary

Harry S. Sawyer, superintendent of the Wico Electric Company, West Springfield, Mass., died November 30 at the Chapin Memorial Hospital in Springfield. Mr. Sawyer was forty-two years old and had been connected with the Wico Electric Company for about two and a half years. He was a member of the Engineering Society of Western Massachusetts.

Edward Wills, who was connected with the Northwestern Public Service Company of Huron, S. D., died October 22 at Columbus, Neb., after an illness of only three days. Mr. Wills' association with the Northwestern property and other companies now in the Albert Emanuel organization dates back eleven years. In 1914 he entered the employ of the old Union Power & Light Company at North Platte, Neb. He was later transferred to Osceola, Iowa, as manager in charge of that property. He was occupying that position when the Albert Emanuel Company absorbed the Union Power & Light Company. When the Osceola property was sold to the Iowa Southern Utilities Company he remained with that organization. Subsequently Mr. Wills rejoined the Albert Emanuel organization at Watertown, S. D., later being transferred to the Northwestern Public Service Company's commercial department. Mr. Wills was a native of Calumet, Mich., and was forty-four years of age.

Francis Wallace Willcox, for the past two years identified with the Edison Lamp Works of the General Electric Company, died in New York on December 1. Born in Memphis on September 6, 1867, he was educated at West Point, being graduated in 1889. After a short period in the army he joined the Thomson-Houston Electric Company, Atlanta, selling electrical mining apparatus, lamps, meters, etc., until May, 1895, when he went to the Edison Lamp Works of the General Electric Company at Harrison, N. J., as assistant manager of lamp sales. In October, 1910, he left for South America to undertake special lamp work, and early in February, 1911, he went to the British Thomson-Houston Company, England, where he later became general manager of the lamp and wiring supplies department. While there he was prominently identified with the introduction of American standards and methods. On November 1, 1923, he returned to the Edison Lamp Works of the General Electric Company, where until the time of his death he was engaged on special duties. Mr. Wilcox had been a well-known figure in the electrical industry.

Commission Rulings

Cash or Stock Dividends Should Be Paid Directly.—The Ojai Power Company requested permission from the California Railroad Commission to issue $50,000 of common stock to pay the cost of constructing additions and betterments to its plants and properties. It desired to sell $30,000 of this stock to its stockholders at par, the stockholders to pay 66⅔ per cent in cash and the company to charge the balance to its surplus account. The commission in authorizing the company to issue $50,000 par value of its common capital stock at not less than par said that the company's proposal amounted to a declaration of a $10,000 stock dividend and added: "We believe that the matter should be handled in a different manner, and that if applicant desires to pay a $10,000 cash or stock dividend, it should do so directly, and not indirectly as part of the purchase price of stock." The commission therefore authorized the company to use $10,000 to reimburse its treasury and thereafter be distributed as a dividend and $40,000 to be sold and the proceeds used for the purposes set forth in the company's application.

"One-Man Utility" Criticised. — That a community cannot be reasonably well served by a central-station company owned and operated by a single individual is intimated in a decision of the Massachusetts Department of Public Utilities handed down in a complaint made by the Selectmen of Chester against the Chester Electric Light Company. The company has a capital stock of $5,000, served 126 customers at the close of last year and had lately been earning dividends at the rate of 12 per cent annually. E. LeRoy Gardner, sole operator and principal owner, testified at the hearing before the board that the residence lighting service had been poor but would be improved as soon as the installation of new equipment could be completed. Generators driven by oil engines are used and a new unit will shortly be installed. In its finding the board ordered the company to file a simpler rate than is now in vogue, on penalty of itself fixing the maximum price; advised the company to employ more labor, and announced that if the present equipment should prove inadequate, arrangements may be made to secure a supply of electricity from the lines of the Turners Falls Power & Electric Company.

Proper Method of Protection Against Delinquent Customers. — The Willow River Power Company was ordered by the Wisconsin Railroad Commission to reconnect premises upon the payment of the usual restoration-of-service charge where service had been discontinued for the failure of a former occupant to pay the company's bills. The commission said: "In support of its refusal to reconnect the premises the company contends that the payments made by the former customer were on account generally and that he in no way designated them as applying to any particular part of his indebtedness. The company, therefore, insists on applying his payments to service charges, house wiring and interest first, leaving under this theory a balance of $59.90 due on the general equipment and local equipment charges, which under the company's rules must be paid before it is obligated to render service in the first instance. A utility is entitled to adopt reasonable rules to insure the prompt payment of its lawful charges against consumers. In this case the company could have refused to connect the premises in question until full payment of the general equipment and local equipment charges was made, and if there was reasonable doubt as to the customer's credit, it might have demanded from him a reasonable deposit to insure the payment of service bills as a condition precedent to rendering service. The company did not avail itself of these methods of protecting its credit, but voluntarily advanced credit. Under these circumstances it cannot look to the subsequent owners of the property to make good the failure to pay."

Recent Court Decisions

Wisconsin Commission Cannot Pass Upon Reasonableness of Public Utility Lease.—The Wisconsin Supreme Court has affirmed the decision of the Circuit Court that the Wisconsin Railroad Commission has no authority to pass on the reasonableness of a lease by a public utility company of a plant built by a company which never operated it. The case involved the Chippewa Power Company, which built the Jim Falls hydro-electric plant on the Chippewa River and leased it to the Wisconsin-Minnesota Light & Power Company (now the Northern States Power Company) without ever having operated the plant. The Railroad Commission scheduled a hearing on the lease, whereupon the Chippewa Power Company applied for an injunction against the commission on the ground that the company was not a public utility. This contention has been sustained.

Telegraph Company Must Share Expense of Eliminating Inductive Interference.—In the case of the Postal Telegraph Company vs. the California Railroad Commission, the Supreme Court of California handed down a decision on November 5 upholding the action of the commission in assessing to the telegraph company a portion of the cost of relocating the Postal's lines on a section of its Benicia-Sacramento circuit for the purpose of avoiding and removing inductive interference caused by the proximity of its lines to the 60-kv. power lines of the Pacific Gas & Electric Company. Although the Postal lines were constructed prior to the building of the power line, nevertheless, on account of numerous changes which had taken place on both lines since their construction, the commission felt it proper and equitable for each company to pay half the cost of removing the Postal lines for a part of the distance, which was found by the commission's engineers and those of the two parties concerned to be the cheapest means of eliminating the inductive interference. The court held that the commission was acting within the limits of the police power of the state.

Judgment in Lockport (N. Y.) Power Contract Case.—The Supreme Court of New York has handed down its decision upholding the sixteen-dollar electric power contract made in 1906 which gives to the manufacturers of Lockport 20,000 hp. on call. The Niagara, Lockport & Ontario Power Company and its subsidiaries will, it is understood, take an appeal to the Court of Appeals at Albany on the grounds that the city of Lockport violated the contract, since its industries failed to call for the full allotment of power from the date of the contract.

Order to Extend Service to Populous District Cannot Be Confiscatory per Se. —The United States Supreme Court has affirmed a decision that for a regulatory body to direct an extension of a public utility in a populous area cannot in itself be confiscatory. The decision was made on the appeal of the Woodhaven Gas Light Company against the Public Service Commission of New York. The commission had ordered extensions of gas mains to five communities in Queens Borough, Greater New York. The company resisted, claiming that its rate was too low and that extensions would increase its losses. The testimony showed, however, that the company had made extensions to some of the points as well as to other points in the vicinity.

Experiment with Clearly Confiscatory Rate Fixed by Statute Not Obligatory Before Seeking Legal Remedy.—In Brooklyn Union Gas Company vs. Prendergast, one of the numerous cases growing out of the "dollar-gas" law passed by the New York Legislature, it was set up by the defense that the act should not be declared confiscatory until the plaintiff should have experimented with the statutory rate. The United States District Court, admitting this to be a general rule, held that the case came under a well-recognized exception, thus expressed by the United States Supreme Court: "Of course, there may be cases where the rate is so low, upon any reasonable basis of valuation, that there can be no just doubt as to its confiscatory nature, and in that event there should be no hesitation in so deciding and in enjoining its enforcement without waiting for the damage which must inevitably accompany the operation of the business under the objectionable rate." In another case the Supreme Court said: "It cannot be doubted that in a clear case of confiscation it is the right and duty of the court to annul the law." (7 Fed. (2d) 628.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Manufacturing and Markets

Management Is Industry's Great Problem

Relations Between Workmen, Organization and Public—Cost of Living and Wages from a Typical Plant—Progress of Industry Dependent on Basis of Service

THE reason for the existence of agriculture, trade and transportation is service to society, said Gerard Swope, president of the General Electric Company, in an address delivered at the twenty-eighth annual dinner and meeting of the Illinois Manufacturing Association, Chicago. Mr. Swope called attention to the necessity for the development of the waste forces of water power and pointed out that when all the sources of power which can be developed most economically have been put to work power can be furnished at a lesser cost and in greater abundance, relieving the drudgery in the household as well as reducing labor in the operation of the farm. He also favored the electrification of transportation lines, especially where traffic is dense or in cities where the removal of smoke and dirt becomes an important factor in making the living conditions more endurable.

A GREAT RESPONSIBILITY

"The great problem of industry today," said Mr. Swope, "is management. This has been the problem since the beginning of the factory system. By management I mean that part of the organization which is intrusted with the responsibility of leadership, for planning so that the workmen are supplied with work with the least waste of time and effort; that part of the organization which has the responsibility for the correct relations and attitude between workmen and the organization as a whole and the responsibility for the correct interpretation and the proper relations of the organization as a whole to the public."

Referring to the relation between the workmen and the organization, Mr. Swope said: "If the surroundings in the factory are clean and good and conducive to the greatest effort and the men are encouraged to the greatest productivity, with the assurance that as a reward their earnings will be in proportion to their productivity, if their confidence is respected, then even in the largest organizations where it is impossible to have a personal relation between management and men, if men have an opportunity of expressing themselves, asking questions and having them answered frankly and fearlessly, an admirable *esprit de corps* can be built up that will compare favorably with the best that has been done in other kinds of organizations."

After referring to the concentration of industry in larger units as shown by the United States census and the increase in power back of the workman, Mr. Swope, to show the relation, especially of the increase in power in back of each workingman to the earnings of the workingman and to the prices to the public of the commodities so produced, quoted figures taken from his own organization. "I have taken as typical our largest single plant, employing some 22,000 people," he said. "The figures have been tabulated from 1912 and for each of the years following including 1924. In that period the cost of living increased about 65 per cent, while the earnings of the workingman—I do not mean the rates per hour, I mean the actual amount of dollars taken home by the wage earner at the end of the week—increased 100 per cent; in other words, doubled. In that same period the electric power consumed at this plant, much of which is obtained from a public utility company operating many hydro-electric plants, has also doubled, increasing from 45,000,000 kw.-hr. in 1912 to 90,000,000 kw.-hr. in 1924. One other significant figure is that the number of workingmen during this period has increased but 17 per cent. This is in line with the declared policy of our country in the restriction of immigration, so that to make our workmen more efficient and do the work that is necessary without a great increase in number it is essential to supplement their ability and strength by more power, and that power electrical.

"During this same period the output of this factory measured in dollars has increased 172 per cent. It will be seen that this is greater than the increase

Value of Electrical Exports for October, 1925, Compared with Corresponding Month in 1924

(Issued by Bureau of Foreign and Domestic Commerce)

Articles	October 1924	October 1925
Generators:		
Direct-current:		
Under 500 kw.	$133,622	$84,468
500 kw. and over	67,056	18,190
Alternating-current:		
Under 2,000 kva.	10,356	13,380
2,000 kva. and over	172,400	180,581
Steam-turbine generator sets	16,768	6,606
Accessories and parts for generators	83,162	89,505
Self-contained lighting outfits	72,508	93,996
Batteries:		
Flashlight batteries	65,819	75,239
Other primary batteries	82,572	111,324
Storage batteries	225,418	219,001
Transforming or converting apparatus:		
Power transformers	224,389	113,383
Other transformers	121,979	96,106
Rectifiers, double-current and motor generators, dynamotors, sychronous and other converters	90,548	84,518
Transmission and distribution apparatus:		
Switchboard panels, except telephone	128,584	270,881
Switches and circuit breakers over 10 amp	144,066	141,677
Fuses and fuse blocks	18,907	21,768
Watt-hour and other measuring meters	52,146	24,151
Volt, watt and ampere meters and other recording, indicating and testing apparatus	122,766	153,240
Lightning arresters, choke coils, reactors and other protective devices	75,367	64,612
Motors, starters and controllers:		
Motors, under 1 hp	126,969	201,776
Stationary motors:		
1 to 200 hp.	183,279	240,321
Over 200 hp.	331,897	103,201
Railway motors	90,972	40,826
Electric locomotives:		
Railway	34,750	43,070
Mining and industrial	26,716	75,582
Starting and controlling equipment for:		
Industrial motors	110,363	97,678
Electric railway and vehicle motors	10,768	46,311
Accessories and parts for motors	187,548	147,656
Electric fans	31,143	51,345
Electric lamps:		
Metal-filament	103,236	112,809
Other electric lamps	35,086	17,457
Flashlights	67,463	78,307
Searchlights and projectors	26,576	40,910
Motor-driven household devices	79,432	135,315
Domestic heating and cooking devices	106,283	117,895
Industrial electric furnaces and ovens	19,450	7,786
Therapeutic apparatus, X-ray machines, galvanic and faradic batteries, etc	74,551	104,053
Signal and communication devices:		
Radio apparatus	769,249	1,317,846
Telegraph apparatus	35,604	26,806
Telephone apparatus:		
Magneto telephones	32,089	12,331
Other telephones	23,656	42,545
Telephone switchboards	44,862	8,805
Other telephone equipment	172,881	135,832
Railway signals, switches and attachments	52,982	17,571
Bells, buzzers, annunciators and alarms	15,142	12,941
Other electric apparatus:		
Spark plugs, magnetos and other ignition apparatus	164,167	173,349
Insulating material	146,064	166,564
Metal conduit, outlet and switch boxes	64,337	67,813
Sockets, receptacles and lighting switches	110,746	129,416
Electric lighting switches, interior and street	73,586	147,468
Other wiring supplies and line materials	94,747	76,520
Other electrical apparatus	728,297	572,522
Globes and shades for lighting fixtures	37,799	50,136
Electrical glassware except for lighting	15,672	29,416
Electrical porcelain	117,581	†
Electrical porcelain for less than 6,600 volts	*	74,546
For 6,600 volts and over	*	39,963
Carbons, carbon brushes and electrodes	203,721	†
Electrodes for electric furnaces	*	217,214
Other carbon products	*	85,608
Insulated wire and cable (iron and steel)	16,461	15,806
Other manufactures of aluminum	49,457	54,445
Copper, bare wire	193,306	195,495
Copper, insulated wire and cables	446,841	371,205
Total electrical machinery and apparatus and supplies	$6,864,172	$7,567,087

*Not separately stated prior to January 1, 1925.
†Discontinued beginning January 1, 1925.

in the average wage paid. This is partly accounted for by higher material costs, which also reflect labor used by others in the production of material for this plant. The increased use of power has assisted in keeping down costs, for while the cost of living has increased 65 per cent, the average price of the articles made by the company during this period has increased but 19 per cent, showing that these products are relatively lower than most necessities, as reflected by the increased cost of living.

"It seems to me that industry must proceed along this line if it is to preserve the high standard of living and the high wage that this country believes in. If it is to maintain its position not only abroad but even in this country, it must become more efficient by supplementing the workingman's intelligence and brawn by more power. Improved methods of doing work are not only going to stimulate the interest of workingmen and tend toward an increase in productivity and the maintenance and increase of his earnings, but will lower the selling prices to the public, which is the test of the stewardship that has been reposed in management of industry. I have no doubt that with an adequate conception of these problems management will respond to this responsibility and society will be well served."

Wiring-Device Sales Active and Growing

SALES of wiring devices are still running in good volume, according to several leading manufacturers, and it is expected that the total output of their factories this year will exceed that of 1924. The remarkable expansion of the building industry in 1925 has been largely responsible for the increased production of switches, sockets and convenience outlets. Downward trends in the price list, on the other hand, have resulted in lower sales in dollars in some cases; but manufacturers generally are looking forward to excellent trade in 1926.

The market is rapidly growing in its capacity to absorb switches of the toggle type. Some manufacturers report that within the past two or three months their sales of toggle switches have exceeded their output of push-button switches, though this is not universally the case. Square toggles are coming into more general use. The demand for plugs and receptacles is naturally vigorous on account of the rising sales volume of socket appliances, but production is on a great scale and competition is so sharp that not a few manufacturers are complaining about little or no profit from this class of business at the moment. Cheaply built foreign supplies are also causing some trouble in the American market, although some of our own export business is holding up well.

Raw material and labor conditions are reasonably satisfactory in this branch of the industry. Hand-to-mouth buying by distributors continues, and frequently this is accompanied by increased transportation costs resulting from rush orders which have to be trucked over part at least of the route from factory to jobber in order to meet delivery requirements. It is expected that the flow of wiring-device shipments, to the smaller distributors in particular, for stocking will fall off perceptibly between now and the new year on account of their desire to keep down inventories. A must unusual amount of development work in wiring devices has been done this year, many specialties having been put on the market with considerable promise of becoming staples within the next year or two. Another encouraging factor in the outlook is the nation-wide interest being shown in the "red seal" plan, with its approval of adequate wiring installations and educational stimulus in contractor-dealer and even popular circles to provide liberally for the use of electric service in designing and specifying new installations and in revamping old layouts.

The Jobber and His Vocabulary*

Need for a Complete Understanding and the Capacity to Be Understood—Attitude of the Central-Station Company Regarding the Jobber and His Function

BY HOWARD A. LEWIS
Business Manager *Electrical Merchandising*

AS NEAR as I can discover, the older manufacturers, the contractors and all jobbers of the electrical industry today talk a wiring-device language; the non-electrical merchant who is in the electrical business talks a merchandise language; the central-station companies that are selling merchandise speak with a sophomoric twang and are developing a merchandising vocabulary on a highbrow but a technically correct basis. The specialty selling organizations, those nervous high-pressure children of our big cities, speak a bastard Esperanto with gestures, and while at times you may not understand the words, you can always follow the foot-and-arm movements and get the general meaning. The inventive genius of the century has been focused on the domestic electrical business—household labor-saving devices, radio, style merchandise. The public urge has created electrical outlets everywhere. The electrical jobber has had in every case first claim on the business. The offer many times was a fleeting one, but it has always been made. The producers who today do not use his services and the retail outlets that spurn his advances both indict this jobber on three counts: First, his language, which they do not understand; second, stocks that he will not carry, and, third, discounts which he will not give predicated on the service which is wanted.

A representative of a large holding company stated it clearly when he said: "What does an electrical jobber do? He carries stocks, he has an assortment of merchandise, he does sales work, and he gives a line of credit. Now, we do not want a line of credit, and we do not want his sales work, but we do want stock to draw on, and we do want an assortment. We can get an assortment, but we cannot always get the stock. We will pay for two of these things, but we will not pay for the others." This man was talking a hard-boiled merchandising language. He was thinking straight on his economics. The line of talk the electrical jobbers' salesmen give to contractors would be wasted words on him. The central-station companies are studying this merchandising question. They are today weighing values. They are breaking down their costs of doing business into the fundamental pieces. They are starting to do what the jobber did for his own business years ago.

If the jobber can perform any part of this merchandising service cheaper than they can do it themselves, he is welcome to a share of this business. But—and here is the joker—the jobber himself has got to sell the central-station company the fact that he can do the work cheaper or better, or both. This is the task for the executive of the jobbing organization. His salesmen with their wiring device and contracting vernacular are out of order. There must be a meeting of minds of men who talk the same merchandising language and whose concepts of merchandising, assortment, sales and credit are the same before a satisfactory business relationship can exist.

CENTRAL-STATION MERCHANDISING

Today the central-station companies are selling nearly $100,000,000 worth of merchandise yearly. They are adding new lines and reaching out for greater sales. Seventy per cent of the generating equipment of the country is controlled by less than twenty companies, and the holding company is part of the picture. I recently made a canvass of the large New York holding companies and found two very interesting things: First, that the head office is leaving it up to the local property to do its own merchandising buying. Any quantity discounts accruing to the holding company are passed back to the individual property. Second, better than 50 per cent of all holding-company-merchandising business is today coming through jobbers.

Many central-station men are thinking very seriously about the jobber and his function. They accuse him of not carrying adequate stocks, of passing orders through to manufacturers for factory shipment, and they resent the brokerage that he makes on this kind of business. As one central station man said: "If the jobber is only going to be a truckman from the railroad station to my warehouse, I want a regular trucking firm to do this work. It costs less." They also feel that when they deal directly with the manufacturer they get better adjustment service and that

*From an address before the Electrical Supply Jobbers' Association, Buffalo, N. Y., November 19, 1925.

time is lost when orders are passed through jobbers for reorder from the manufacturer. The smaller central-station companies also feel that the jobber's salesmen are order takers, not "ambassadors with sales ideas." As one operator expressed it: "When the jobber's salesman calls, the manufacturer's representatives stay away, and we need that manufacturing contact for the help that we get from his salesmen." This was from the representative of a group of small central-station companies. He admits that his local companies need sales help, a consideration that does not apply to the larger companies.

On the other side of the picture, the jobber with a warehouse of merchandise well assorted is accepted as an economic factor that aids in eliminating time and distance. This is particularly true on new items where the central-station company cannot budget its sales or purchases. Incidentally, the central-station companies are going in for budget control. With seasonable lines every one concedes the jobber's place; the only quarrel is that his service is not always comprehensive enough. I might add that many utility companies —indeed, most retail outlets in every line—are today infected with the "one-twelfth-of-a-dozen" disease.

Discount Schedules Complicate

There are certain manufacturing discount schedules that complicate the situation. But they or their equivalent have always existed, and as long as quantity enters into the buying and selling picture they will continue to exist. During this period of the central station's merchandising "renaissance" the value of rotund stocks when you want them and where you want them far outweighs an extra 5 per cent at the end of a twelve-month period, provided that when such things are discussed the jobber and the central-station company speak the same merchandising language and observe the same club-room niceties.

The question arises: "What's the good of learning to talk a merchandising language if our contracting customers insist on talking wiring?" After eight years of educational propaganda the contractors as a class have made very little merchandising progress. But here is the strange part of it—the electrical contractors always have a merchandising opportunity. This is particularly true in our smaller cities and larger towns. Wherever service enters into the electrical picture the public is willing to accept their claims for the business.

But the contractor, no matter how good his store location and the physical equipment that he installs, who sticks to a wiring-device vernacular and a wiring supply point of view can never compete with real merchants, because the public does not understand his language and does not have to go to the trouble of trying to learn. The intelligent contractors are going to do some merchandising business. I believe this absolutely, just like I believe he muffed a special opportunity—thanks to all of us—eight years ago. But it is the individual contractor who is going to go a certain distance with merchandising, not the contractors as a group. We do not expect plumbers to sell grand pianos, but they can sell bathroom fittings, and with many electrical items the analogy is not far-fetched. A beautiful portable lamp or a fancy radio set that becomes the *pièce de résistance* of your living room has the same sales psychology as a grand piano. Would you trust these sales to a plumber? Well, then, do not expect the impossible from the electrical contractor.

Most non-electrical outlets are merchants and talk a merchandising language, and they are in the electrical business—all kinds of them. Here the jobbers compete not only among themselves and with the manufacturers, but with other trade jobbers. I believe in the next five years, when the smoke clears away, that such of the electrical jobbers as care to specialize in merchandise lines will have a surprising number of non-electrical accounts—and profitable ones too. There is no law to stop them from hiring good salesmen who talk merchandising language, and when it comes to stocks and electrical assortments, why, the other fellow is an "also ran."

I doubt if any electrical jobber will ever be able to talk the merchandising language of all the household things that will eventually become electrified. I believe he will always have a first refusal, or—a more constructive way to put it—the first opportunity, on new lines, because he is here with the machinery to give time and place value to any line of electrical merchandise. However, what he does not take up and carry somebody else will. The task will be done.

Business Conditions

EXTENSIVE industrial-plant purchasing comprises a major part of the current business transacted in the electrical industry. Many sections of the country report interesting sales. Cement mills purchased considerable equipment, much apparatus was ordered by a mining company for its various properties, and pulp and paper mills and the steel industry were active buyers. Many plans for delayed plant extensions and improvements are under way. Present inquiries for quotations are in sufficient volume, say the manufacturers, to presage continued good business well into next year.

Sales of wire and cable continued in good volume, with competition keen. Some seasonal slacking up has been noticed, although orders for about $1,500,000 worth of cable were placed by a central-station company in Michigan. Street-lighting equipment has been in strong demand. A prominent manufacturer of ornamental street-lighting standards reports sales in November as the best in the company's history and states that its 1925 business is already double that of last year. The increased activity in the steel industry and the good consumption have led to a stiffening of prices. The result has been a good demand for pole-line hardware, conduit, boxes and related material. A large mail-order house has reported that its sales in November were 10 per cent above those made in the same month last year.

In New England an uneven tone has been noted in the demand, particularly for new construction materials and equipment and small motors. Industrial lighting is quite promising, and many negotiations for new installations are pending in that district. Industrial plants have been active purchasers in the New York district, and among the orders placed is one covering two 6,000-hp steam turbines, another for $200,000 worth of equipment for a new plant and another for eight motors aggregating 2,475 hp. A strong demand continues for wire, conduit and other construction material. In the Southeast line-construction material is moving satisfactorily and commercial-lighting fixtures are in good demand. Sales in the Middle West are in large volume and industrial plants are active, with considerable equipment, including turbines, being purchased by cement mills. On the Pacific Coast power equipment is moving well, the steel industry and pulp and paper mills being responsible for excellent business.

Record Volume of Copper Sales in Metal Market

EXCEPT for copper, business in the non-ferrous metal markets during the week has been of modest proportions. The volume of copper sales has been larger than in any week for many months, the ruling price being 14 cents, delivered, with some transactions bringing up to 14⅛ cents for Eastern delivery and 14¼ cents for the Middle West. The lead market declined largely in sympathy with the weakness in London, whereas zinc is a trifle stronger, owing particularly to a squeeze for metal for prompt shipment. Last week Thursday and Friday and on Monday this week sales were the best, with a considerable shrinkage in business Tuesday and Wednesday, despite the fact that the metal is obtainable in several directions at 14 cents, delivered.

Though domestic buying of lead continues in satisfactory volume and producers have very short supplies, the price has declined further owing to continued weakness in London. On Tuesday the American Smelting & Refining Company reduced its contract price from 9⅜ cents to 9¼ cents, New York. The Smelting company's price has been generally obtained by other sellers

NEW YORK METAL MARKET PRICES

	Dec. 2, 1925 Cents per Pound	Dec. 9, 1925 Cents per Pound
Copper, electrolytic	14⅛	14
Lead, Am. S. & R. price	9⅛	9⅛
Antimony	20	20
Nickel, ingot	34	34
Zinc, spot	8.725	9.075
Tin, Straits	63⅛	63⅛
Aluminum, 99 per cent	29	29

Base copper price Dec. 9, 1925, 16½ cents

throughout the week. Almost all the inquiries have been for December shipment and for small individual tonnages, the consumers apparently wishing to take care of only their immediate requirements—a natural attitude in a declining market. For shipment in February and later, the price has been more irregular, sales having been made both above and below the official contract price.

Zinc prices reflect the scarcity of the metal for spot shipment. Some is available, however, and sales have been made at prices ranging from 8.60 cents to 8.80 cents for December. Consumers have taken little interest in the tin market, though the price has held steady. London operators expect the American demand soon to reassert itself.

Line-Construction Material in Demand in the Southeast

LINE-CONSTRUCTION material is moving satisfactorily in the Southeast, and excellent orders for poles and pole-line hardware are reported from the territory generally. However, pole shipments of forty-five days are causing some delay in construction work. Wiring supplies are being taken in good quantities, and socket appliances in all lines are moving briskly. Sales of air heaters have fallen off somewhat in the past week. Commercial lighting fixtures are moving satisfactorily, but the residential type has slowed up markedly in the past ten days.

Late fall and Christmas business is reported excellent by electrical jobbing interests. Here and there are small sections not purchasing in anticipated quantities, but the territory as a whole is exceeding predictions made earlier in the year. The boom conditions in Florida continue, and good orders for all classes of materials are steadily coming in from that state. The present difficulty is not in obtaining orders but in making deliveries after orders are in hand. Shipment into Florida by truck has become the rule, but destruction of road surfaces and inclement weather are making themselves felt in this mode of transportation.

Industrial Plants Large Buyers in the New York District

INDUSTRIAL plant purchasing continues in particularly good volume in the New York district. Several important orders were placed during the week by industrial firms and included one for a mining company covering two 6,000-hp. steam turbines and another for motor-generator sets, switching equipment, etc., for a complete electrolytic leaching plant, amounting to $200,000. Another order for a cement company included eight motors aggregating 2,475 hp. as well as other orders from the same company for wiring material, including one for safety switches amounting to $1,000. Another company planning the installation of a new plant in New Jersey has requested quotations for three 333-kva. transformers and approximately 1,000 hp. of miscellaneous motors. An order for about $15,000 worth of synchronous motors is expected to be placed this month and there are several other prospects amounting to about twice that.

Manufacturers report that continued activity in industrial-plant purchases will without question continue well into next year as inquiries continue to be received in large volume. A small motor manufacturer states that sales in this district up to December 1 are 30 per cent higher than total sales in 1924, and a large manufacturer reports that industrial business is nearly double that transacted last year. Wire is in very good demand; the volume is holding up well, but competition is keen. One wire manufacturer says that his business is about 25 per cent better than last year. There is a slight seasonal reduction in current wire orders, but factories are busy filling orders previously placed.

Central-station buying included no large orders, but aggregate sales of supply material are good. Two or three large propositions are expected to develop by the first of next year or soon thereafter. Three 3,000-hp. hydraulic turbines were purchased by a central-station company in upper New York State. Good sales of pole-line hardware are attributed to the stiffening of the steel market. Jobbers are active and report a continued strong demand for conduit, wire, receptacles and other construction material. A fair amount of export business covering instruments and oil-switch equipment is in prospect.

Power Equipment Moving Well on the Pacific Coast

POWER apparatus is moving very well on the Pacific Coast, the steel industry around San Francisco Bay and the pulp and paper mills of the Northwest having been responsible for some excellent business. The oil industry of southern California has also improved considerably over the dull season of midyear. Power company business has been lighter this past week, the bulk of the business coming from the San Joaquin Valley and including such items as 10,000 pole steps, fifty post hole shovels and $800 worth of bakelite tubing. Railroad purchasing is very good, the outstanding items having been 15,000 steel cross-arm pins, 15,000 dry batteries, 250 lighting units and a miscellaneous lot of pole-line hardware aggregating about half a carload. Nevada business is good, there being a varnished-cambric cable inquiry for about $1,000 from Reno and a 6,000-lb. assortment of No. 8 and No. 10 bare copper and weatherproof wire from Fallon.

There are also many inquiries from California for small and medium-size rural telephone systems and power plants which indicate a return of prosperity to the farmer. Dealers' store business is reported to be still quiet except in radio material. Jobbers report many stock orders for holiday appliances. Steel prices continue to advance, as in the case of rigid and flexible conduit boxes, and numerous 25,000-ft. stock orders for rubber-covered wire are apparently caused by the expectation of further rubber advances.

Uneven Tone Evident in Sales in the New England District

THE steady buying trend which has marked the electrical market in the New England district up to December 1 showed noticeable signs of wavering during the past week, particularly in the movement of new construction materials and equipment and, in addition, in small motor sales. One manufacturer reports a number of inquiries from Southern states concerning transmission-line supplies and equipment for the coming year. Another has received many inquiries for small motors and control equipment. Industrial lighting is quite promising, and many negotiations for new installations are pending. A very large electric sign recently installed in Fitchburg uses forty-four 150-watt lights in floodlight projectors, and indicates the trend in demand for such equipment.

Seasonal business in electrical household appliances, which should be flourishing at this time, is reported for the last week to be lagging and far from showing the usual holiday strength. A prominent central-station manager reports that the apparent sluggishness of the appliance market is due to the tendency to buy electrical appliances "on price." He quotes from experience that holiday demands each year have shown an appreciable increase, adding that this year promises to give an encouraging showing in volume based on the fact that, in general, throughout this territory industrial conditions show a steady improvement.

Sales in Middle West in Large Volume—Industry Active

THE volume of business in the Middle West is increasing, and manufacturers express the opinion that December will complete a very satisfactory year. A considerable amount of apparatus is being purchased by the various utility companies for delivery in the first quarter of next year. Among the orders placed was one for a quantity of 3,000-amp., 15,000-volt circuit breakers and four 15,000-volt transformers. Construction work is slowing down with the cold weather, but every effort is being made to complete work in progress. In the Kansas City territory business for 1925 is reported to be about 8 per cent ahead of that in 1924, with a noticeable lack of large orders for new power-plant apparatus and equipment, although good turbine and apparatus sales are expected in 1926. Cement mills have purchased considerable equipment, including turbines, and large transformer business is fair. Despite a reduction in lamp prices, the value of orders received has increased.

Jobbers report excellent sales and a large increase in 1925, as compared with 1924. There has been a fair increase in the number of jobbers this year, and this has reduced the available business per company. Jobbers in the more western section of the Middle West state that there is a marked increase in the volume of syndicate purchases that are placed locally.

Activities of the Trade

Westinghouse Announces Orders for Steam-Turbine Units

Orders for three large steam turbines and generating units and the auxiliary equipment, aggregating approximately $1,000,000, have been announced by the Westinghouse Electric & Manufacturing Company. With the exception of the electrical generators to be supplied by the East Pittsburgh shops all the equipment will be manufactured at the South Philadelphia works of the company for delivery next year.

The largest contract, including two generating units of 38,000 hp. each, and two steam condensers was received from the Midland Utilities Company of Indiana for installation in the Michigan City power plant. The other contract is for one 34,000-hp. steam turbine and generator for the Broad River Power Company, at Columbia, S. C. This is the second unit of the same type to be installed in this plant, which has been designed for an ultimate total of four units.

Brown, Boveri Denies Rumors of Additional Plant Purchases

It has been rumored that the American Brown, Boveri Electric Corporation had purchased the Ohio Brass Company, the Electrical Development & Machine Company and the Railway Industrial & Engineering Company. Laurence Wilder, president of the Brown, Boveri company, denied the rumors when asked by the ELECTRICAL WORLD if the purchase of these companies had taken place.

New Electric Refrigerator Company Formed in Michigan

United States Senator James Couzens has announced the organization of the Couzens Ice Machine Company, a Michigan corporation with a nominal capitalization of $1,000,000 and the stock of which is held almost exclusively by himself.

The Senator will be president and executive head; Frank Couzens, son of the Senator, is vice-president and treasurer; Clarence E. Wilcox is secretary, and James A. Martin and Ross Schram, formerly associated with the Senator in other enterprises, will be identified with the company.

Commenting upon his entry into the refrigeration field, Senator Couzens said:

"The type we plan to build will be suited for mass production, extremely simple and placed upon the market complete with box for less than half the price of the machines sold today. We have made a very exhaustive investigation and have reached the conclusion that one of three machines can be produced along these lines." This venture marks the return of the Senator, formerly with the Ford Motor Company, to the industrial world after being out of the manufacturing business since 1915.

The Star Electric Motor Company, 142 Miller Street, Newark, N. J., manufacturer of motors, generators and fans, has completed plans for the erection of a new two-story plant, 70 ft. x 90 ft., estimated to cost $90,000, with machinery.

The Standard Underground Cable Company, Pittsburgh, has awarded a general contract for the construction of a two-story addition to its plant at Silvia Avenue and the Kings Highway, St. Louis, estimated to cost $45,000.

The Simplex Wire & Cable Company, Boston, announces that it has opened a branch office in the Lew Building, St. Augustine, Fla., in order to care for a steadily increasing volume of business in that state. F. H. Pettee, who has represented the company in Florida for about two years, will be manager of the new office.

The Burndy Engineering Company, Inc., 10 East Forty-third Street, New York announces that it is now manufacturing its high-tension bus connectors in its New York City plant. The connectors were formerly made for the company by Burke Electric Company.

The Servel Corporation, 51 East Forty-second Street, New York, announces that after January 1 the entire accounting division, now at the Evansville factory, will be transferred to the general office in New York. The company, which established its new general offices on the eighteenth floor of the above building on October 1, states that its rapid development has made it necessary to take over the entire seventeenth floor as well as five offices on the second floor of the same building for its local distributing organization.

The Jewell Electrical Instrument Company, 1640 Walnut Street, Chicago, announces that it is now prepared to supply a complete line of rectangular switchboard instruments to meet the demands for such equipment. The instruments are said to be slightly less than 6 in. wide, so that four of them can be mounted on a 24-in. panel.

The General Electric Company announces the appointment of George A. Wortman as refrigerator specialist with headquarters at 84 State Street, Boston. Mr. Wortman was formerly connected with the fractional-horsepower motor sales department and in his new capacity will act as engineering specialist for the New England district of this company.

New Equipment Available

Bus Supports and Disconnecting Switches

A complete line of substation light-duty bus supports and disconnecting switches has been placed on the market by the Electrical Development & Machine Company, Holmesburg, Philadelphia. The insulator posts are of the corrugated type having inserts cemented into both ends. The disconnecting switches are mounted upon steel-plate bases and are available in standard ratings, with and without locks.

Bus supports are available for flat or pipe mounting and with clamping devices for all commonly used shapes and sizes of conductors. This equipment is adapted to all classes of work, from medium-size generating stations to the smallest industrial substations.

Flexible Couplings

A line of improved "Francke" flexible couplings for motor, turbine and engine drives, known as the bushed-pin type, has been placed on the market by Smith & Serrell, 20 Washington Place, Newark, N. J. The line comprises twenty-one sizes, rated from ⅜ hp. per 100 r.p.m. (4,000 r.p.m. maximum) up to 3,850 hp. per 100 r.p.m. (490 r.p.m. maximum) and for shafts from ¾-in. diameter up to 13-in. diameter. The improved coupling is said to retain the best features of the old heavy-pattern type and in addition has an easier and greater endwise movement, greater power and bore capacities and much longer life for all speeds, and steel flanges for the small and intermediate sizes.

Graphited bronze bushings, which are removably locked in one flange, are used in the size No. 850 and larger. Bronze bushings are used in the smaller sizes. The steel-pin units are free to slide a half inch within these bushings. Contact surfaces are said to be more than doubled, a cylindrical surface is obtained, movement is between steel and bronze, and the graphited bushings present a self-lubricated surface that will retain its lubricating qualities over many years.

Automatic Self-Starting Induction Motor

An automatic self-starting induction motor, known as the type AA, using a standard squirrel-cage induction motor with a double squirrel-cage winding on the rotor, has been placed on the market by the Ideal Electric & Manufacturing Company, Mansfield, Ohio. The outer squirrel-cage winding in the top of the rotor slots has about ten times the resistance of the second squirrel-cage winding in the bottom of the slots. It is said that the motor will start on full line voltage and not take as much current from the line as an ordinary squirrel-cage motor when started with a compensator on the 80 per cent tap. The starting torque is from 135 per cent to 175 per cent of full-load running torque at full line voltage. The type AA motors can be furnished in any size from 3 hp. to 100 hp. or larger if desired.

New Trade Literature

FUSE SUPPORTS.—The Pacific Electric Manufacturing Company, 5815 Third Street, San Francisco, is distributing bulletin No. 504, covering the various types of the Pacific fuse supports. A dimensioned diagram of these types is included as well as a schedule of fuse-tube data.

DIESEL ENGINES.—Bulletin No. 1,020 issued by Fairbanks, Morse & Company, Chicago, entitled "Comparison of Diesel-Engine Principles," analyzes the various factors which influence the design of Diesel engines. The bulletin points out the many advantages, such as mechanical and operating simplicity, and the various points are illustrated and described in detail. In a chapter on "Dissipation of Heat" the factors which influence the horsepower rating of a Diesel engine are covered.

ALUMINUM PAINT. — The Aluminum Company of America, Pittsburgh, is distributing a booklet entitled "Aluminum Paint," which is a treatise on the physical properties of aluminum paint and its uses in modern industry.

INSTRUMENT TRANSFORMERS. — "Instrument Transformers" is the title of bulletin No. GEA-178, issued by the General Electric Company, Schenectady, N. Y., which describes the theory and engineering characteristics of transformers used to facilitate the measurement of electrical quantities. It contains illustrations, diagrams, charts and tables covering various tests. An appendix giving burden data, phase-angle correction factors, characteristic curves, etc., is included.

LIGHTING EQUIPMENT AND SUPPLIES.—The Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, is distributing catalog No. 24, covering the Benjamin electrical products, including industrial lighting equipment, protected lighting equipment, show-window lighting equipment, outdoor lighting fixtures, industrial signals, heavy-duty water-tight wiring devices, shade-holders, reflectors, etc. This catalog is issued in two sizes, one for the pocket and the other for the desk or file.

FUSES.—A motor-rating card for posting wherever motors are used has been issued by the Chicago Fuse Manufacturing Company, Fifteenth and Laflin Streets, Chicago. Besides giving the full-load current, the correct ratings of starting fuses and running fuses for properly protecting different types and sizes of motors are indicated.

PATENTS AND TRADE MARKS.—The third edition of a booklet entitled "Patents" and a fourth edition of one entitled "Trade-marks" have just been issued by Richards & Geier, 277 Broadway, New York. The booklet on patents covers both United States and foreign patents and discusses many items pertaining to the subject. The booklet on trademarks covers trademarks in general in the United States and in foreign countries. It also discusses the registration of trademarks here and in foreign countries.

COMMERCIAL LIGHTING.—The Phoenix Glass Company, Federal Reserve Bank Building, Pittsburgh, has issued catalog No. 40, entitled "Commercial Lighting Units," covering the various types of these units manufactured by it. The company is also distributing two leaflets, one entitled "A Recipe for Better Light in the Dining Room," describing various types of shades for the dining room, and the other describing its ball globes and ruby exit globes.

INDUCTION MOTOR.—Bulletin No. 110 issued by the Ideal Electric & Manufacturing Company, Mansfield, Ohio, describes its type "AA" double squirrel-cage automatic self-starting induction motor.

OIL CIRCUIT BREAKERS. — "Pacific Multi-Break Oil Circuit Breakers" is the title of bulletin 9,000 issued by the Pacific Electric Manufacturing Company, 5815 Third Street, San Francisco, which describes the Pacific multi-break oil circuit breakers and gives details of Pacific circuit-breaker control. Ratio curves, phase-angle curves and wiring diagrams are inclued.

BOILER-FEED PUMPS. — Leaflet No. 2,082 issued by the Allis-Chalmers Manufacturing Company, Milwaukee, describes and illustrates the Allis-Chalmers centrifugal multi-stage boiler-feed pumps. Useful data, such as the pump capacity required for boiler feeding, boiler-feed pump drives, feed-water regulation, etc., are included. Characteristic curves of the various pumps are also shown.

WATER-LEVEL RECORDERS. — Leupold Voelpel & Company, Portland, Ore., have issued bulletin No. 12, describing the Stevens water-level recorders, types A and B, for use on any scale, ink or pencil record, English or metric units. The instrument is a universal recorder for all purposes. The company is also distributing a data book on water-level recorders and indicators, containing descriptions, illustrations and designs of stilling wells and instrument shelters and a treatise on the inherent sources of error in all float-operated devices.

FRACTIONAL-HORSEPOWER MOTORS. —The Brown-Brockmeyer Company, Inc., Dayton, Ohio, is distributing bulletin No. 7-7½, covering its "B-Line" of alternating-current, single-phase, repulsion-induction motors, manufactured in ½-hp. and ¾-hp. sizes only.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency are desired in Stockholm, Sweden (No. 18,077), for electrical household appliances and meat-slicing machines, washing machines and mangles.

An agency is desired in Paris, France (No. 18,067), for electric locomotives for mines.

An agency is desired in Rome, Italy (No. 18,067), for bee-keeping equipment and poultry-raising equipment, including incubators, brooders, etc.

Construction News

Projects, Plans, Bids and Contracts,
Contemplated or Under Way

New England States

WATERVILLE, N. H.—The Parker-Young Company, 131 State Street, Boston, is considering the building of a power house in connection with its proposed local saw mill and lumber plant for raw material for pulp production.

HARTFORD, CONN.—Work is under way by the Hartford Electric Light Company on construction of a substation on Woodland Street. Equipment will soon be installed.

MERIDEN, CONN.—Plans have been authorized by the State Board of Education, Hartford, for the construction of a power house at the local Connecticut School for Boys. Walter T. Arnold, Meriden, is architect.

Middle Atlantic States

ADAMS BASIN, N. Y.—The Adams Basin Electric Light & Power Company has been granted permission to extend its distribution to serve a portion of the town of Sweden.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Dec. 15, for armature machines, dry and flashlight batteries, molded rubber gaskets, motor-generators, mechanical thermometers, belting, etc.

BUFFALO, N. Y.—The City Council is considering the installation of a flashlight signal system in different sections of the city.

GENESEO, N. Y.—The Rochester Gas & Electric Corporation has acquired the electric system of the Geneseo Gas Light Company, and plans extensions and improvements in this district.

GOVERNORS ISLAND, N. Y.—Bids will be received by the Signal Corps Procurement District, Governors Island, until Dec. 15, for 30,200 ft. aerial telephone cable (Circular 11).

LIVINGSTON, N. Y.—The Blue Hill Light & Power Corporation, recently organized, has applied for permission to exercise a franchise granted by the Town Board to distribute electricity here. The company plans to erect a transmission line from the Greenport-Livingston town line to the Potts Memorial Tuberculosis Hospital, and from there to Blue Stores, at a cost of about $16,000.

SKANEATELES, N. Y.—Permission has been granted the Niagara, Lockport & Ontario Power Company, Buffalo, to erect electric lines in this village for the purpose of supplying power to the municipal power station.

SYRACUSE, N. Y.—Four lighting districts, three in the town of Salina and one in the town of Van Buren, has been established by the Board of Supervisors of Onondaga County. They include the Melvin Tract lighting district, Hinsdale lighting district and Cold Springs road lighting district, in the town of Salina, and the Memphis lighting district, in Van Buren.

WARRENSBURG, N. Y.—The new transmission line of the Adirondack Power & Light Corporation, Schnectady, from Spiers Falls to Warrensburg is expected to be completed about Jan. 1. When this line is finished, it is planned to erect lines from Warrensburg to Chestertown, Lake George and Bolton.

CAMDEN, N. J. — The East Camden Business Men's Association has petitioned the City Commission for the installation of additional street lamps on Federal Street and Westfield Avenue in the downtown section.

KEANSBURG, N. J.—Steps have been taken by property owners on Church Street for the installation of ornamental lamps on that thoroughfare.

MARLTON, N. J.—The Public Service Electric & Gas Company, Newark, plans to erect a transmission line along the Marlton Pike to Marlton to furnish service here.

PRINCETON, N. J.—An electrical laboratory equipped for testing and research will be installed in the proposed building to be erected for the School of Engineering, Princeton University, to cost about $500,000. Generating apparatus, motor equipment, switchboards, etc., will be installed. Prof. Arthur M. Greene, Jr., dean of the school of engineering, is in charge. Day & Klauder, Franklin Bank Building, Philadelphia, are architects.

ALBION, PA.—The electric plants and properties of the United Lighting Company at Albion and Conneautville, have been acquired by the Penn Central Light & Power Company, Altoona. Plans are under way for extensions in the spring.

BETHEL, PA.—The Blue Mountain Electric Company has applied for permission to take over and consolidate the East Hanover Electric Company, Cold Spring Electric Company and the Grantville Electric Company. Extensions and improvements are planned in transmission system.

BROOKVILLE, PA.—Permission has been granted the Borough Council to take over the electric plant and system of the Solar Electric Company, to be owned and operated by the municipality. Extensions and improvements are planned. Bonds to the amount of $100,000 have been approved for purchase of the plant and for improvements.

CLARENDON, PA.—Work has started on the erection of a 7-mile transmission line from Warren to Clarendon by the Penn Public Service Company, Warren. A substation will be erected here.

LAURYS STATION, PA.—The Pennsylvania Power & Light Company, Allentown, plans to build a switching and substation here to be used in conjunction with its generating plant at Hawley.

MOSIERTOWN, PA.—Plans are under consideration for establishing a street-lighting system throughout the village, to cost about $15,000. Post Office address is Saegerstown, Pa.

PITTSBURGH, PA.—Permission has been granted the Duquesne Light Company to erect a transmission line in Beaver County.

PITTSBURGH, PA.—Plans are under way by the West Penn Power Company for extensions in transmission lines and for additional substations.

ZELIONOPLE, PA.—Plans are being prepared by the Elliott Nursery Company, Magee Building, Pittsburgh, for warehouse, power plant, greenhouses, etc., to cost about $50,000.

BALTIMORE, MD.—Bids will be received by the Board of Awards, office of the City Register, City Hall, until Dec. 16, for cast iron lamp posts and sub-bases.

PRINCESS ANNE, MD.—The Princess Anne Electric Company is planning to erect a transmission line to Marion and to

furnish service in a number of communities in this section.

NORFOLK, VA.—The Old Dominion Distillers' Corporation, National Bank of Commerce Building, plans to install electric power equipment in its proposed local plant, to cost about $250,000. Calrow, Browne & Fitzgibbon, New Monroe Building, are architects.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Dec. 23, for two single-phase transformers; twelve sets of storage batteries; 5,000 ft. high tension ignition cable; 6,000 ft. low tension ignition cable, etc. (Panama Circular 1712).

North Central States

ANN ARBOR, MICH. — The Detroit (Mich.) Edison Company, is planning to rebuild its local Argo power plant, recently damaged by fire with loss of about $45,000.

BATTLE CREEK, MICH.—Plans for a proposed local hospital, to cost about $700,000, include a power house. E. M. Brigham, Battle Creek, and associates, are interested in the project. Schmidt, Garden & Martin, 104 South Michigan Avenue, Chicago, are architects.

PONTIAC, MICH.—The Oakland Motor Car Company plans to install electric power equipment in connection with extensions to its plant, to cost about $3,000,000.

PORT HURON, MICH.—Plans are being considered by the Detroit Edison Company for extensions and improvements in its local power plant on Bunce Creek, to cost about $1,000,000.

MUSKEGON, MICH.—Permission has been granted the Muskegon Power & Light Company to build a power dam and hydro-electric plant on the Muskegon River near Paris, to cost about $500,000.

TALBOT, MICH.—The local electric distribution system has been acquired by the Menominee & Marinette Light & Traction Company, Menominee To furnish service here will require an extension of its lines in Michigan, a distance of about 7 miles. Talbot has not a post office.

WILLIAMSTON, MICH.—Plans for the proposed local factory to be erected by the Michigan Clay Products Company, Lansing, to cost about $75,000, include a power house.

CLEVELAND, OHIO.—The Detroit electric service station, located at 1.986 East Eighty-fourth Street, was recently destroyed by fire, causing a loss of about $75,000.

CLEVELAND, OHIO—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Dec. 18, for pole type constant-current regulators for the Division of Light and Power.

OAK HILL, OHIO—Plans for rebuilding the brick and tile manufacturing plant of the William E. Dee Company, recently destroyed by fire, with a loss of about $270,000, include a power plant.

RUSSELL'S POINT, OHIO—Authority has been granted the Ohio Edison Company, Springfield, to purchase the property of the Indian Lake Light & Power Company. Extensions and improvements will be made to the system.

TOLEDO, OHIO—Extensions and improvements are contemplated by the Willys-Overland Company during the coming year, involving an expenditure of about $2,000,000. Included in the program is the erection of several new units and the revamping of others. Extensive improvements will be made to the power house, including new boilers, compressors, stokers, etc.

PADUCAH, KY.—The Kentucky Utilities Company, Louisville, which recently acquired the property of the Paducah Electric Company, plans to erect a high-tension line from Paducah to the western Kentucky coal fields, where it will connect with its transmission system, operating in that section.

EVANSVILLE, IND.—Plans for the proposed furniture factory to be erected by the American Woodcraft Corporation, 702 West Pennsylvania Avenue, at a cost of about $75,000, include a power plant.

SHELBYVILLE, IND.—Plans for the proposed new plant of the Shelbyville Desk Company, to cost about $60,000, include a power plant.

WABASH, IND.—Bids will be received by the Board of Education until Dec. 16, for electric lighting fixtures, shop equipment, laboratory equipment, etc., for the new local high school. J. Edwin Kopf & Deery, Indiana Pythian Building, Indianapolis, are architects.

CHICAGO, ILL. — The Bell & Howell Company, 1803 Larchmont Avenue, plans to install electric power equipment in its proposed plant addition, to cost about $275,000. Pond & Pond, 6 North Michigan Avenue, are architects.

CHICAGO, ILL.—Bids will be received by the Signal Corps Procurement District, Chicago, until Dec. 17, for 5,000 telephone receivers, 5,000 receiver shells, 10,000 receiver caps, and 5,000 receiver diaphragms (Circular 12). Also, until Dec. 18, for desk stand cords, ear cushions and rubber gaskets. (Circular 14).

GREAT LAKES, ILL.—All bids submitted for ash-handling system for the local Naval Training Station have been rejected by the Bureau of Yards and Docks, Navy Department. New bids will be asked.

JOLIET, ILL.—The Public Service Company of Northern Illinois, Chicago, Ill., is planning to erect a 66,000-volt line from Joliet to Lemont, a distance of about 20 miles.

ASHLAND, WIS.—The Lake Superior District Power Company has made arrangements with the Village Board at Glen Flora for the installation of a street-lighting system. The company has also reached an agreement with the business men in Ogema to install a street-lighting system there. Both towns will be served by the proposed high-tension line to be erected between Medford and Big Falls power plant.

BERLIN, WIS.—Plans have been completed by the Wisconsin Power & Light Company for rebuilding its local power plant. New switchboard equipment will be installed and a foundation laid for a second turbine unit, to be installed when needed.

GREEN BAY, WIS.—Arrangements have been made by the Wisconsin Public Service Corporation with the village officials of Abrams and Lena, whereby street-lighting systems will be installed in both places.

LA CROSSE, WIS.—The stockholders of the Wisconsin Railway, Light & Power Company, which supplies electric light and power service in a number of communities in western Wisconsin and eastern Minnesota, and street car service in La Crosse and Winona, Minn., have adopted plans to issue $1,500,000 in capital stock, of which $500,000 will be issued at once to finance extensions and improvements. The name of the company has been changed to the Mississippi Valley Public Service Company.

MENESHA, WIS.—The City Council has authorized the installation of ornamental lamps the entire length of Main Street, and on portions of Racine, Washington and Tayco Streets, to cost about $13,500.

SUPERIOR, WIS.—The power house of the Superior Shipbuilding Company was recently destroyed by fire, causing a loss of about $20,000.

ROCHESTER, MINN.—All bids submitted Nov. 23 for the police and fire-alarm telegraph system have been rejected by the City Council. New bids will be called for later. The cost is estimated at about $12,000.

ST. PAUL, MINN.—Plans are being considered by the City Council for the installation of ornamental lamps on the boulevard from Summit Avenue to West Seventh Street, to cost $33,200, and on South Robert Street from Fillmore Avenue to Concord Street, to cost $20,000.

DES MOINES, IOWA—The Des Moines Electric Light Company has acquired the lighting systems in Altoona and Mitchellville. The company is now serving from its new plant a chain of cities which includes the Ataloosa group of eight municipalities, Adel and ten surrounding towns and Colfax, Altoona and Mitchellville. Extensive improvements and extensions are contemplated for the whole group.

HOSPERS, IOWA—The local electric light plant has been acquired by the Northwestern Light & Power Company, Cedar Rapids. The company plans to erect a high-tension transmission line from Paulina to Granville, and eventually, it is expected, will connect Hospers with the Granville plant.

STORM LAKE, IOWA—In a report submitted by Frank Mack, engineer, engaged by the City Council to make a preliminary survey and estimates for a municipal electric plant and distribution system, the cost is placed at $170,000. The cost of the plant is estimated at $88,000, and the distribution system, $82,000.

Southern States

NORWOOD, N. C.—The Carolina Power & Light Company, Raleigh, contemplates a hydro-electric development, including dam about 80 ft. high, on the Colson place, near Norwood.

RALEIGH, N. C.—Work will soon begin on the construction of an electrical engineering building, to cost about $200,000, at the North Carolina State College. The equipment will include testing and research laboratories, generating and switchboard apparatus, etc. Hobart Upjohn, Grand Central Terminal, New York, is architect.

COCHRANE, GA.—Plans are being considered by the City Council for the construction of an ice-manufacturing plant in conjunction with the municipal electric plant and waterworks system.

WARWICK, GA.—The Commissioners of Crisp County, Cordele, have applied to the Federal Power Commission for permission to build a hydro-electric plant on the Flint River, near Warwick, to develop an initial capacity of 20,000 kw. The Southern Engineering Corporation, Albany, is engineer.

FORT MYERS, FLA.—The installation of ornamental lamps from Fort Myers to Punta Rassa and San Carlos-on-the-Gulf, a distance of 20 miles, is under consideration by the City Council.

MIAMI, FLA.—Plans are under way to extend the ornamental lighting system on North West Seventh Avenue from its present terminus to the Broward County line, a distance of about 7 miles.

MONTICELLO, FLA. — Arrangements have been made for installing electric lamps on the highway between Aucilla and Monticello. Electricity to maintain the lamps will be supplied by the local plant. Ornamental lamps will be erected between Monticello and Wacissa, as soon as the State highway is completed.

ORLANDO, FLA.—The purchase of a Gamewell fire-alarm and police signalling system has been authorized by the City Council. The total cost of the system is estimated at $76,000. About $50,000 will be expended at this time.

ST. PETERSBURG, FLA.—Plans are being considered by R. E. Ludwig, director of Public Utilities, to extend the electric power and light service to Bayboro Harbor.

ST. PETERSBURG, FLA.—The Crystal Ice Company, 908 Fifth Avenue, North, plans to install electric power equipment in its proposed ice-manufacturing plant on Thirtieth Avenue, North, to cost about $200,000.

MURFREESBORO, TENN. — The property of the Murfreesboro Light & Power Company has been acquired by the Tennessee Electric Power Company, Chattanooga. Later on the company plans to extend its transmission lines to all sections of Rutherford County.

NASHVILLE, TENN.—A resolution has been adopted by the City Council providing for the installation of ornamental lamps on several streets, the lamps to be maintained by the municipal electric plant.

DAPHNE, ALA.—Application has been made by the Deuel Power Company, Robertsdale, for permission to built an electric light and power plant here.

GADSDEN, ALA.—Plans for the proposed local hosiery mill of the Davis & Allcott Company, include an electric power plant.

GOODWATER, ALA.—The Alabama Power Company, Birmingham, has petitioned for permission to build a substation in Goodwater and the right to extend its transmission line (about ½ mile) to Goodwater to connect with the local distributing system.

HARTSELLE, ALA. — The Alabama Power Company has applied fof permission to erect a transmission line from Hartselle to Falkner with a distribution system at the latter place.

RIVER FALLS, ALA. — Preliminary plans are under way by the River Falls Power Company for a third hydro-electric plant near Gantt, work to begin during 1926. Construction is under way on the second station. The Southern Engineering Corporation, Albany, is engineer.

LEWISVILLE, ARK.—Plans are under way by the Arkansas Light & Power Company, Pine Bluff, for the erection of a high-tension transmission line from Lewisville to Magnolia.

ALEXANDRIA, LA.—The Alexandria Ice & Cold Storage Company plans to install electric power equipment in two proposed

local ice-manufacturing plants to cost about $200,000.

COYLE, OKLA.—Plans are being considered by the Town Council for the erection of a 33,000-volt transmission line from Coyle to Ripley, a distance of 18 miles, to cost about $30,000.

KINGFISHER, OKLA.—At an election to be held Dec. 8 the proposal to issue $40,000 in bonds for extensions and improvements to the municipal electric plant will be submitted to the voters.

KIOWA, OKLA.—The Southwest Power Company, McAlester, has been granted permission by the Corporation Commission to construct and operate an electric distribution system in Kiowa.

MEDFORD, OKLA.—The United Power Company, Helena, which has acquired the municipal electric plant, plans to build a high-tension transmission line to Jefferson, a distance of 10 miles, as soon as possible.

MENHAN, OKLA.—Arrangements have been made with the Oklahoma Gas & Electric Company, Oklahoma City, to supply electric lamps here.

TONKAWA, OKLA.—The United Light & Power Company, Pond Creek, has applied for a franchise to supply electric service in Tonkawa.

BRYAN, TEX.—Surveys are being made by the Western Public Service Company, Calvert, for the erection of a high-tension transmission line from Navasota to Bryan.

MARSHALL, TEX. — The East Texas Public Service Company plans to erect a 66,000-volt transmission line from Big Sandy to Mineola.

PALESTINE, TEX.—The City Council has awarded a contract to the Texas Power & Light Company, Dallas, to rebuild the ornamental lighting system in the downtown section of the city.

Pacific and Mountain States

PORTLAND, ORE. — Plans are under way by the Northwestern Electric Company for extensions and improvements in its power station to cost about $40,000, and also to construct an equipment storage and distributing plant, on Lewis Street, to cost $125,000. Martin Schacht, Yeon Building, is architect.

BERKELEY, CAL.—Plans are under consideration for an ornamental lighting system on University Avenue, using two-lamp standards. F. B. Rae is city electrical engineer.

LONG BEACH, CAL.—The installation of ornamental lamps on Bay Shore Walk, to cost about $25,000, is under consideration by the City Council.

LOS ANGELES, CAL.—The Water and Power Commission, 207 South Broadway, has rejected all bids submitted for a Diesel engine generating set. New bids it is understood, will soon be asked.

LOS ANGELES, CAL.—The City Council has passed ordinances providing for the installation of ornamental lamps on Norton Avenue and La Jolla Avenue, using concrete standards and on Glendale Boulevard, using pressed steel standards.

PASADENA, CAL.—The City Council is considering the installation of ornamental lamps on Pasadena Avenue, using reinforced-concrete standards.

SAN DIEGO, CAL.—Plans for the proposed steel mill to be erected in this section by the Studebaker Corporation, South Bend, Ind., at a cost of $10,000,000, is reported to include a power plant.

SAN DIEGO, CAL.—The San Diego Consolidated Gas & Electric Company plans to begin work early next year on a new 3,750-kw. substation for city distribution. The initial installation will include two 11,000-kw. incoming feeders and 4,000-kw. outgoing feeders as well as street-lighting circuits.

SAN FRANCISCO, CAL. — Work will begin at once on the diversion dam and intake for Pit No. 4 hydro-electric development of the Pacific Gas & Electric Company. A 40-ft. dam is to be built 1¼ miles downstream from Pit No. 3, which was placed in operation in July last. The work now to be done involves an expenditure of about $1,750,000, while the estimated cost of the Pit No. 4 development is $14,500,000.

SALT LAKE CITY, UTAH.—The Utah-Idaho Sugar Company, it is reported, plans to build a power plant in connection with its proposed beet sugar mill in the Willamette Valley. The cost of the entire project is estimated at $1,000,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued November 17, 1925)

1,562,204. ELECTRIC FURNACE CONTROL; R. Carlstedt, Stockholm, Sweden. App. filed June 24, 1924.

1,562,211. SUPERVISORY SYSTEM; J. C. Field, Orange, N. J. App. filed Oct. 18, 1921.

1,562,224. ELECTRICALLY HEATED SADIRON; H. Gansert, Jr., Syracuse, N. Y. App. filed Oct. 20, 1924.

1,562,247. ELECTRIC SWITCH MECHANISM; A. H. Nero, New Britain, Conn. App. filed July 23, 1921. Pullchain socket.

1,562,261. ELECTRIC FURNACE; J. Sechowski, Notre Dame, Ind. App. filed Aug. 17, 1923. Hot-air type.

1,562,263. ELECTRIC MOTOR AND GENERATOR; J. C. Sommer, St. Louis, Mo. App. filed June 16, 1924.

1,562,273. RECORDING INSTRUMENT; A. Amsler, Schaffhausen, Switzerland. App. filed June 17, 1924. Of the remote-station type.

1,562,277. PROCESS OF PREPARING ELECTRODES; F. Bahr, Berlin, Germany, App. filed Dec. 11, 1922.

1,562,293. ELECTRIC WATER HEATER; G. R. Conklin, Miami, Fla. App. filed July 25, 1924.

1,562,349. ELECTRICAL CURLING-IRON HEATER; T. S. Lorenze and W. S. Schmidt, Chicago, Ill. App. filed May 4, 1923.

1,562,379. ELECTRICAL CONNECTOR DEVICE; W. D. Steele, Evanston, Ill., and R. B. Benjamin, Chicago, Ill. App. filed Dec. 8, 1919. Duplex socket.

1,562,396. ELECTRON DISCHARGE DEVICE; F. E. Ward, Corona, N. Y. App. filed June 4, 1923.

1,562,402. RADIO CHANDELIER; A. O. Wilson, Wayne, Mich. App. filed June 9, 1924. Lighting fixture and loud speaker combined.

1,562,403. ELECTRON DISCHARGE DEVICE; J. R. Wilson, New York, N. Y. App. filed Dec. 19, 1924.

1,562,406. PORTABLE LIGHT; C. E. Woodville, Chicago, Ill. App. filed June 13, 1921.

(Issued November 24, 1925)

1,562,436. TRANSLATING DEVICE; M. P. Chaplin, White Plains, N. Y. App. filed Oct. 31, 1921. For translating current impulses into mechanical movements.

1,562,457. PRINTING-TELEGRAPH MACHINE; O. L. Kleber, Pittsburgh, Pa. App. filed Feb. 15, 1921.

1,562,460. FULGURATOR; W. D. McFee, Haverhill, Mass. App. filed April 26, 1922. Therapeutical device for treating tonsils.

1,562,485. MOVEMENT AND POSITION INDICATOR; H. A. Affel, Brooklyn, N. Y. App. filed May 5, 1923. Radio signaling system.

1,562,494. RENEWABLE ELECTRIC FUSE; F. N. Conant, Newburyport, Mass. App. filed March 5, 1923. Cartridge type having knife-blade fuse terminals.

1,562,500. RECEIVING CIRCUIT FOR LOW-FREQUENCY IMPULSES; L. Espenschied, Hollis, N. Y. App. filed Sept. 26, 1919.

1,562,526, 1,562,527, 1,562,528. TELEPHONE-EXCHANGE SYSTEM; J. F. Toomey and H. E. Phelps, New York, N. Y. App. filed Aug. 16, 1923. Automatic.

1,562,545. APPARATUS FOR TESTING TELEPHONE RECEIVERS; V. Durbin, Newton, Mass. App. filed April 13, 1923.

1,562,552. ELECTRIC IRON PLUG; F. H. Hanley, Detroit, Mich. App. filed Feb. 9, 1923.

1,562,569. OSCILLATING-CURRENT SYSTEM; C. V. Logwood, New York, N. Y. App. filed May 28, 1921. For radio communication.

1,562,574. PORTABLE BURGLAR ALARM; G. J. Maud, Adena, Ohio. App. filed July 10, 1923. Which may be placed near a window or door for giving an alarm whenever desired.

1,562,575. ELECTRIC IRON; N. I. Merkeel, Yorktown Heights, New York. App. filed April 26, 1923.

1,562,601. SNAP SWITCH; W. C. Tregoning, Cleveland, Ohio. App. filed July 19, 1919. For lamp sockets.

1,562,611, 1,562,612. ELECTRICAL FIXTURE-SUPPORTING DEVICE; R. B. Benjamin, Chicago, Ill. App. filed May 20, 1921. "Elexit" type.

1,562,619. VARIABLE INDUCTANCE; R. W. Campfield, Berkeley, Cal., and R. M. Wise, Oakland, Cal. App. filed July 25, 1923. For use in high-frequency circuits as in radio telegraphy.

1,562,646. RECTIFIER RELAY; W. Kaisling, Chicago, Ill. App. filed Feb. 5, 1918.

1,562,647. CONTACT-BANK STRUCTURE; W. Kaisling, Chicago, Ill. App. filed April 1, 1922. Switches of the step-by-step type.

1,562,649. SWIVEL-SHELL ATTACHMENT PLUG; S. McClatchie, Cambridge, Mass. App. filed Nov. 20, 1920.

1,562,684. SYNTHESIZING GASES IN ELECTRIC FURNACES; M. J. Brown, Niagara Falls, N. Y. App. filed Oct. 2, 1922.

1,562,689. PUSH-BUTTON SWITCH; W. W. Dean (deceased), late of Lowell, Mass. App. filed Dec. 8, 1923.

1,562,695. CIRCUIT CLOSER; J. S. Gaines and M. E. Creighton, Cairo, Ill. App. filed March 31, 1922. Signal circuit for use in conjunction with boilers.

1,562,698. ELECTRIC SWITCH; G. H. Hart, West Hartford, Conn. App. filed March 3, 1923. Rotary handle.

1,562,730. MAGNETIC SCREW; B. Andrews, Houston, Tex. App. filed May 4, 1925. Reciprocating device controlled by a rotating member having helically arranged ribs similar to screw threads.

1,562,738. HIGH-TENSION ELECTRIC SWITCH; G. A. Burnham, Saugus, Mass. App. filed filed April 23, 1921. Oil type.

1,562,739. ELECTRIC SWITCHING APPARATUS; G. A. Burnham, Saugus, Mass. App. filed May 17, 1922. Cell-type oil switch.

1,562,765. RAIL BOND; W. F. Hart, Pittsburgh, Pa. App. filed Sept. 22, 1922.

1,562,786. REGULATION OF POLYPHASE COMMUTATING MOTORS; J. Perret, Paris, France. App. filed March 20, 1922.

1,562,820. RADIO RECEIVING SYSTEM; J. R. Brady, Somerset, Md. App. filed Aug. 22, 1923.

1,562,825. ELECTRIC FURNACE; G. Evreynoff, Ekaterionslav, Russia. App. filed Nov. 11, 1924. Arc type.

1,562,836. PIN FOR INSULATORS; W. D. Kyle, Milwaukee, Wis. App. filed Nov. 15, 1922.

1,562,844. TRANSMISSION CIRCUITS; H. W. O'Neill, Brooklyn, N. Y. App. filed Aug. 14, 1923. Testing or service observing arrangement for signaling systems.

1,562,846. ANTI-FRICTION MATERIAL AND METHOD OF MAKING THE SAME; C. Q. Payne, New York, N. Y. App. filed Feb. 5, 1923.

1,562,877. RADIO-RECEIVING SYSTEM; W. G. Ellis, Philadelphia, Pa. App. filed June 16, 1922.

1,562,903. ELECTRICAL DRIVE FOR AUTOMOBILES; A. Miller, New York, N. Y. App. filed June 16, 1924.

1,562,917. METHOD OF AND MEANS FOR INCREASING THE TURNING MOMENT IN INDICATING DEVICES; O. Richter, Neumuhlen, near Kiel, Germany. App. filed March 11, 1925.

1,562,932. MOUNTING FOR THERMOSTATIC ELEMENTS; C. B. Walker, Moseley, England. App. filed Oct. 7, 1924.

1,562,943. TELEGRAPH SYSTEM; G. C. Cummings, Orange, N. J. App. filed June 30, 1924. Duplex system.

1,562,947. ELECTROMAGNETIC DEVICE; A. J. Eaves, Ossining, N. Y. App. filed April 21, 1923. Polarized telegraph sounders.

1,562,950. SIGNALING BY ULTRA-AUDIBLE SOUND WAVES; R. A. Fessenden, Brookline, Mass. App. filed Dec. 14, 1918.

1,562,952. ARC CONVERTER; L. F. Fuller, Palo Alto, Cal. App. filed March 16, 1921.

1,562,955. POWER-LINE SIGNALING; A. M. Granich, New York, N. Y. App. filed April 7, 1924.

1,562,959. ELECTRIC ARC DEVICE; E. L. Harrington, Saskatoon, Saskatchewan, Canada. App. filed March 22, 1921. Rectifier employing inclosed arcs.

1,562,961. DIRECTIVE RADIO-TRANSMISSION SYSTEM; R. A. Heising, Millburn, N. J. App. filed May 16, 1921.

1,562,964. MULTIPLEX CARRIER-WAVE TRANSMISSION; J. W. Horton, Bloomfield, N. J. App. filed Feb. 28, 1923.

1,562,968. MOTOR-CONTROL SYSTEM; B. W. Jones, Schenectady, N. Y. App. filed May 6, 1924.

1,562,984, 1,562,985. INCASED FUSE; T. E. Murray, Brooklyn, N. Y. App. filed April 4, 1921. Renewable.

1,563,004. METHOD OF AND MEANS FOR OPERATING ELECTRIC MOTORS; E. F. Alexanderson, Schenectady, N. Y. App. filed June 12, 1924. Of the series type.

1,563,007. SELECTING SYSTEM; J. H. Bell, East Orange, N. J. App. filed Feb. 12, 1917. Electromechanical type; for use in printing telegraphy.

1,563,041. ELECTROPLATING APPARATUS; F. G. Purinton, Waterbury, Conn. App. filed Sept. 7, 1923. Employing a rotary barrel or drum.

Financial and Corporate

Utility Trend Upward

Gains Outnumber Losses in Unlisted Group—American Waterworks Jumps to Record High

IN A WEEK that revealed a generally firm market for industrials and railroad shares, and which included the day on which the Sixty-ninth Congress assembled, the market in power and light issues continued upward. While there were instances of weakness in the list, the gains outnumbered the losses, just as they did in groups of other description.

On the New York Stock Exchange attention was directed to the impressive performance of the American Water Works & Electric Company's stock. This stock, which less than two years ago was selling below 40 for the old issue, climbed to a new record high above 71. The stock has been split on a basis of five to one since the rise began, so that at 71 the new stock is selling at an equivalent to 355 for the stock that will be remembered at levels below 40. Explanation for the sustained advance is to be found partly in the fact that in the case of this particular company a relatively small amount of stock is outstanding in comparison with the large amount of value represented by the properties. Even within the present calendar year, American Water Works & Electric Company's stock sold as low as 34⅜. The new price of 71 is, of course, a high record for all time.

Among the gainers on the New York curb and the unlisted markets were Washington Railway & Electric, which improved its position by ten points; Eastern Texas Electric, which rose seven; El Paso Electric, which rose four, and Mississippi River Power, which added five points to its position of the week before. Tampa Electric also responded to a good report of earnings. Smaller gains were registered by Galveston-Houston Electric and Arizona Power preferred.

Not all of the net changes represented gains. Ground was lost by such stocks as Georgia Railway & Power and Southern Cities Utilities.

New Capital Issues

During the past week the Northern States Power Company of Minnesota made an offering of first lien and general mortgage gold bonds, series B, to the amount of $8,500,000. These bonds, dated December 1, 1925, and due December 1, 1950, were priced at 100 and interest, yielding 5.50 per cent.

The Potomac Edison Company floated a loan of $2,250,000 in the form of first mortgage and refunding gold bonds, series D, the price being 96 and interest, yielding over 5.80 per cent, and the Penn-Ohio Edison Company an additional issue of 7 per cent cumulative prior preference stock amounting to $1,000,000. Also represented was the Suburbn Light & Power Company of Ohio with a one-million dollar issue of first mortgage bond-secured gold notes priced at 99 and accrued interest, to yield over 6.3 per cent. The largest individual offering was made by the Cities Service Power & Light Company in the form of 7 per cent cumulative preferred stock discussed elsewhere in this section.

New Utility Corporation Formed

In a letter to stockholders Frank T. Hulswit, president of the United Light & Power Company, announced the organization of the American States Securities Corporation to deal in utility corporations, corporations associated with the utility industry and in other enterprises approved by the directors. Stockholders of United Light will have the right to acquire share for share one share of class A common and one-half share of class B common of the Securities Corporation. The new company is absolutely independent of the United company.

Dividends Declared

The quarterly dividends listed below have been announced recently by electric light and power companies and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Allis-Chalmers, pf.	1¾	Jan. 15
American & Foreign Power, pf.	$1.75	Jan. 2
American Gas & Electric, com.	.25	Jan. 2
American Gas & Electric, pf.	$1.50	Feb. 1
American Gas & Electric, com.‖	.....	Jan. 2
American Public Service, pf.	$1.75	Jan. 2
American Public Utilities, pr. pf.	$1.75	Jan. 2
American Public Utilities, pte. pf.	$1.50	Jan. 2
Bangor Hydro-Electric, pf.	1¾	Jan. 2
Blaw-Knox, extra	4	Dec. 24
Brazilian Trac., Lt. & Pwr., pf.	1¾	Jan. 1
Calumet Gas & Electric, pf.	1¾	Dec. 17
Carolina Power & Light, com.	.50	Nov. 30
Central Illinois Public Service, pf.	$1.50	Jan. 15
Central States Electric, pf.	1¾	Dec. 31
Chicago Fuse Manufacturing	.62½	Jan. 1
Consolidated Gas (N. Y.) pf.	1¾	Feb. 1
Detroit Edison	2	Jan. 15
Eastern New York Utilities, pf.	1¾	Jan. 2
East Kootenay Power, pf.	1¾	Dec. 15
Electric Power & Light, pf.	$1.75	Jan. 2
Emerson Electric & Mfg., pf.	1¾	Jan. 1
General Gas & Electric, com. A	37½	Jan. 2
General Gas & Electric, pf. A $8	$2	Jan. 2
General Gas & Electric, pf. B	$1.75	Jan. 2
Illinois Power & Light, 7% pf.	1¾	Jan. 2
Illinois Power & Light, 6% pf.	1¾	Jan. 2
Illinois Public Service, pf.	$1.50	Jan. 15
Indiana Service, pf.	1¾	Dec. 1
Ingersoll-Rand, pf.	3	Jan. 2
Interstate Power, pf	1¾	Jan. 1
Iowa Power & Light, 7% pf.	1¾	Jan. 2
Kansas City Pwr. & Lt., 1st pf. A	$1.75	Jan. 1
Kansas Gas & Electric, pf.	1¾	Jan. 2
Kelvinator Corporation, cap (ex.)	.50	Jan. 1
Manhattan Electric Supply	$1 12½	Jan. 2
Middle West Utilities, pf.	$1.75	Jan. 15
Minnesota Electric Dist., com.*	1	Dec. 10
Minnesota Electric Dist., pf. A*	2-3	Dec. 10
Minnesota Electric Dist. pf. B*	1	Dec. 10
Minnesota Electric Dist., pf. C*	7-12	Dec. 10
Minnesota Power & Light, pf.	1¾	Jan. 2
Missouri Power & Light, 7% pf.	1¾	Jan. 2
Monon.-West Penn Pub. Serv., 7% pf.	.43¾	Jan. 1
Montana Power, com.	1	Jan. 2
Montana Power, pf.	1¾	Jan. 2
National Electric Power, pf.	1¾	Jan. 2
National Public Service, cl. A com.	.40	Dec. 15
Niagara Falls Power, com.	.50	Dec. 31
Niagara Falls Power, pf.	.43¾	Jan. 15
North American, pf.	.75	Jan. 2
North American, com.	2½†	Jan. 2
North Amer. Light & Power, 7% pf.	1¾	Jan. 2
North West Utilities, 7% pr. ln. pf.	$1.75	Jan. 2
North American Utility Securities 1st pf. allotment ctfs.	$1.50	Dec. 15
Northern Ohio Trac. & Lt., 7% pf.	1¾	Jan. 2
Northern Ohio Trac. & Lt., 6% pf.	1½	Jan. 2
Ottawa & Hull Power, pf.	1¾	Dec. 15
Penn Central Lt. & Pwr., cum. pf.	$1.25	Jan. 2
Pennsylvania-Ohio Electric, pf.	$1.75	Dec. 1
Pennsylvania Water & Power	2	Jan. 2
Public Service Electric & Gas, 6% pf.	1½	Dec. 31
Public Service Corp. of N. J., com.	$1.25	Dec. 31
Public Service Corp. of N. J., 8% pf.	2	Dec. 31
Public Service Corp. of N. J., 7% pf	1¾	Dec. 31
Public Service Corp. of N. J., 6% pf.	1½	Dec. 31
Southern Canada Power, pf.	1¼	Jan. 15
Southwestern Gas & Electric	$1.75	Jan. 2
Southwestern Lt. & Pwr., com. A	$1.50	Dec. 20
Southwestern Light & Power, pf.	$1.50	Jan. 2
Tri-State Utilities, com.*	‡	Dec. 10
Utah Power & Light, pf.	1¾	Jan. 2
Utilities Power & Light, cl. A	.50‡	Jan. 1
Utilities Power & Light, cl. B	.....	Jan. 1
Utilities Power & Light, pf.	$1.75	Jan. 1
Westinghouse Electric & Mfg., com.	$1	Jan. 30
Westinghouse Electric & Mfg., pf.	$1	Jan. 15
Weston Electrical Instrument	.50	Jan. 2
Winnipeg Electric, pf	1¾	Jan. 1
Yale & Towne Manufacturing, spec.	$1	Dec. 22
Yale & Towne Manufacturing, reg.	$1	Jan. 2

* Monthly. † Payable in common stock. ‡ Payable either in cash or class A stock at the rate of one-fortieth of a share. ‖One-fiftieth share of new non par common.

Cities Service Stock Issue

Doherty Organization Plans to List Its New Preferred Shares on New York Stock Exchange

BY PAUL WILLARD GARRETT

AMONG the largest of the recent offerings of power and light issues was the flotation a little over a week ago of a ten-million-dollar series of 7 per cent cumulative preferred stock by the Cities Service Power & Light Company. The new shares, offered to the public at 98¾ flat to yield in excess of 7 per cent, will be listed both on the New York and Boston Stock Exchanges.

In the aggregate the earnings of the Cities Service Power & Light system now reach an annual total of $47,291,948, that being the amount reported for the twelve months ended June 30, 1925. For the period under review operating expenses, maintenance and taxes totaled $28,688,879, leaving net income of $18,603,069. Interest charges and preferred dividends of the subsidiaries, minority interests and depreciation, including the interest charge for the full period on the holding company's 6 per cent series A bonds and the 6 per cent two-year notes, aggregated $13,950,468. Deducting these various charges from the indicated balance leaves a balance available for preferred dividends for the period of $4,652,601. Annual dividend requirements on the new ten-million-

dollar issue of 7 per cent stock will, of course, be about $700,000. Thus it appears that earnings of the Doherty holding company have been running at a rate sufficient to cover dividend requirements on stock presently to be outstanding between six and seven times.

On completion of the new financing how will the company's capital structure look? The funded debt of the utility on June 30, 1925, consisted of $24,750,000 of twenty-year 6 per cent secured sinking-fund bonds of 1944 and a 6 per cent two-year unsecured note for $1,000,000 due in 1927. Additional series of the sinking-fund bonds may be issued under restrictions designed to protect present investors, and, it may be added, the 7 per cent cumulative preferred stock is authorized to the amount of $50,000,000, but certain provisions here also are designed to protect stockholders against the issuance of stock in excessive amounts at any particular time. The 7 per cent cumulative preferred stock is followed by a total authorized issue of 650,000 shares of common stock, all of which is outstanding and over 90 per cent of which is owned by the Cities Service Company.

German Loan Floated

On Wednesday the German General Electric Company (Allegemeine Elektricitäts-Gesellschaft) made an offering of $10,000,000 fifteen-year 6½ per cent gold sinking-fund debentures at 94 and interest, to yield about 7.16 per cent. Each debenture carries a stock purchase warrant entitling the holder to purchase shares of the common stock of the company of the par value of 100 reichsmarks each (about $23.80 at par of exchange) carrying unmatured dividend coupons.

Key West Electric Sold

The Engineers' Public Service Company is to acquire control of the Key West Electric Company, according to an announcement made by C. W. Kellogg, president of the former company. Under the plan approved by a majority of Key West stockholders they are to receive one-third of one share of 7 per cent preferred and one share of no-par common of Engineers' stock for each share of Key West common held. Gross earnings of the Key West company in the year ended October 31 were $258,869, and the balance available for reserves and common stock after interest and preferred dividends was $48,549.

Activity in Detroit Edison Stock.—All sorts of rumors are afloat with reference to the Detroit Edison Company. In many quarters it is asserted that the Electric Bond & Share Company has been an active purchaser, but this is denied by persons in a position to know. Some months ago, when a Middle West banking house was buying into Detroit Edison, the stock market quotations went so high as to cause Alex Dow, the president of the company, to issue a statement on the value of the stock and a reaction set in. The stock is again active, and it is evident that control is being sought. By whom it is not known, but the Electric Bond & Share Company denies any interest.

Utility Merger Completed.—Stockholders of United Investors Securities' Company, having taken favorable action at a meeting held December 7, the consolidation between that company and the National Power & Light Company is now effective, as it was approved by stockholders of the National Power & Light Company on November 30.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Dec. 5	Low 1925	High 1925
STOCKS			
Abitibi Pwr. & Paper, com.—no par	f71¼	62	75½
Adirondack Pwr. & Lt.—7% pf.	101	98	106
Adirondack Pwr. & Lt.—8% pf.	107	103	115
Adirondack Pwr. & Lt., com.—50	l 75	31	98
Ala. Pwr., pf.	104	97½	106
Allis-Chalmers Mfg. pf.	f108½	103½	108½
Allis-Chalmers Mfg., com.	f 91½	71½	95
Amer. & Foreign Pwr., pf. 25% pd.	l130	129½	142
Amer. & Foreign Pwr., 7% pf.	f 93½	87	94
Amer. & Foreign Pwr., com.	f 43½	27½	51⅝
Amer Bosch Magneto, com.—no par	f 34½	26½	54½
Amer. Brown, Boveri, ptc., stk.	f 49½	49½	53½
Amer. Elec. Pwr., pf.	c 101½	91	104½
Amer. Gas & Elec., 6% pf.—no par.	91	85	93
Amer. Gas & Elec., com.—no par.	79	70	85
Amer. Lt. & Trac., 6% pf.	114	93	115
Amer. Lt. & Trac., com.	265	139	288
Amer. Pwr. & Lt., 6% pf.	93½	84	95
Amer. Pwr. & Lt., com.—no par.	61	52	67½
Amer. Pub. Serv., 7% pf.	96	88	96
Amer. Pub. Serv., com.	47	45	90
Amer. Pub. Utilities, 4% pf.	80	....	....
Amer. Pub. Utilities, 6% pf.	80	71	82
Amer. Pub. Utilities, 7% pf.	87	87	95
Amer. Pub. Utilities, com.	78	70	103
Amer. Superpwr., pf.—25	f 25	....	....
Amer. Superpwr., Class A—no par.	f 32½	....	....
Amer. Superpwr., Class B—no par.	f 34½	....	....
Amer. Wtr. Wks. & Elec., 7% pf.	101½	97½	103
Amer. Wtr. Wks. & Elec., com.	f 73½	34½	72½
Appalachian Pwr., 7% pf.	101	92	100
Appalachian Pwr., 1st pf., 7%	101	95	101
Appalachian Pwr., com.—no par.	78	70	83
Arizona Pwr., 7% pf.	83	75	87
Arizona Pwr., com.	32	15	34½
Arkansas Cent. Pwr., pf., $7—no par	100	97	102
Arkansas Lt. & Pwr., 7% pf.	98	92	102
Arkansas Lt. & Pwr., com.	100	65	101
Asheville Pwr. & Lt., 7% pf.	k101½	93	104
Assoc. Gas & Elec., 7% pf.—1% extra—50	f 49	....	....
Assoc. Gas & Elec., pf.—$6—no par	l 82	....	....
Assoc. Gas & Elec., Class A	f 34½	....	....
Babcock & Wilcox, com.	f 144	....	....
Birmingham Elec. pf.—$7—no par.	102	98	103
Blackstone Valley Gas & Elec., com.—50	93	....	....
Blaw-Knox, com.	l 60	59	60
Brazilian Trac., Lt. & Pwr., com.	f 80	....	....
Broad River Pwr., pf.	94	90	97
Brooklyn Edison, com.	f 136½	120½	156½
Buffalo Gen. Elec., com.—no par.	l 58	50	77
Buffalo, Niagara & East. Pwr., pf.—25	k24	....	....
Buffalo, Niagara & Eastern Pwr., com.	k30½	....	....
Carolina Pwr. & Lt., pf.—$7—no par	105	100	107
Carolina Pwr. & Lt., com.	430	290	456½
Central & S. W. Utilities, 7% pf.—no par	a 88½	88	90½
Central & S. W. Utilities, pr. In. pf.—no par	a 98½	96½	100
Central Ariz. Lt. & Pwr., pf.	101	100	106
Central Ark. Ry. & Lt., 7% pf.	96	91	98½
Central Ill. Pub. Serv., 6% pf.	86	84	93
Central Ind. Pwr., 7% pf.	85	88	95
Central Pwr. & Lt., pf.	94½	88	96½
Central States Elec., 7% pf.	94	87	98
Central States Elec., com.	220	70	250
Century Elec., com.	f 103	103	110
Chicago Fuse Mfg., com., no par	a 32½	27½	39½
Cincinnati Gas & Elec., com.	g 91	82	90
Cities Service, 6% pf.	84	80	84
Cities Service, pf. B—10	f 7⅞	....	....
Cities Service, pf. BB—100	f 76	....	....
Cities Service, com.—20	38½	34	43
Cities Service, Bks. Shrs.—10	17½	16½	22
Cleveland Elec. Illg., 6% pf.	102	101	105
Cleveland Elec. Illg., com.	240	200	250
Colorado Pwr., 7% pf.	96	93	98
Columbia Gas & Elec., 7% pf.	112½	104½	113½
Columbia Gas & Elec., com.—no par	f 81½	45½	86
Columbia Ry., Gas & Elec., 6% pf.	90	90	90
Columbus Elec. & Pwr., 2d pf.	c101	....	....
Columbus Elec. & Pwr., com.	f 150	....	....
Columbus Ry., Pwr. & Lt., pf. A	98	86	99
Columbus Ry., Pwr. & Lt., pf. B	92	80	85
Columbus Ry., Pwr. & Lt., com.	150	114	150
Commonwealth Edison, com.	a 138	130½	141½
Commonwealth Pwr., 6% pf.	87	80	88
Commonwealth Pwr., com—no par.	35	30½	43½
Conn. Lt. & Pwr., 8% pf.	118	115	118
Conn. Lt. & Pwr., 7% pf.	111	105	110
Cons. Gas of N. Y., pf.—50	f 57½	....	....
Cons. Gas of N. Y., com—no par	f 96½	74½	96½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	c 103½	102	105
Cons. Gas, Elec. Lt. & Pwr. of Balti., 6½ pf.	c 108½	105	110½
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	c 111	109	114
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	c 125	122	127½
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par	c 43½	32	47½
Cons. Utilities of Dela., 7% pf.	85	80	84
Consumers Pwr., 6% pf.	96	90	97
Consumers Pwr., 6 6% pf.	101	97	102
Continental Gas & Elec., 7% ptc. pf	95½	85	97
Continental Gas & Elec., 7% pr. pf.	96	89	95
Continental Gas & Elec., com-no par	145	77	145
Crocker Wheeler, com.	15	14	28
Crocker Wheeler, pf.	50	58	80
Dallas Pwr. & Lt., 7% pf.	102	100	102½
Dayton Pwr. & Lt., 6% pf.	95	88	100
Dayton Pwr. & Lt., com.	420	180	460
Detroit Edison, com.	k143½	110	159½
Dubilier Condenser & Radio, com.	11	....	....
Dubuque Elec., 7% pf.	91	80	90
Duquesne Lt., 7% pf.	109	104	112
East. Tex. Elec., 7% pf.	100	100	105
East. Tex. Elec., com.—no par.	80	70	75½
Edison Elec. Illum. of Boston, com.	d 209½	200	213
El Paso Elec., com.	f 78	....	....
El Paso Elec., pf.	f 101	....	....
Elec. Bond & Share, 6% pf.	k103½	101½	106½
Elec. Bond & Share Sec., com.—no par	k 67½	56½	80½
Elec. Investors, 6% pf —no par.	92	95	96
Elec. Investors, com.—no par	71	30	79½
Elec. Investors, 10% pd. receipts	53	15	62
Elec. Pwr. & Lt., ctfs. pf.	f 94½	89½	94½
Elec. Pwr. & Lt., ctfs., 40% pd.	f 107½	100	110
Elec. Pwr. & Lt., ctfs. full pd.	106	100½	110½
Elec. Pwr. & Lt., ctfs., com.	f 31½	17½	40½
Elec Ry. & Securities, com—no par.	24	....	....
Elec. Storage Battery, com.—no par	f 78½	60½	80
Elmira Wtr., Lt. & R.R., 7% pf.	96½	93	98
Emerson Elec., pf.	f 100	95	101½
Empire Dist. Elec., 5% pf.	80	78	85
Engr. Pub. Serv., pf.—no par.	99	100	103
Engr. Pub. Serv., com.—no par.	24	19½	30
Eureka Vacuum Cleaner, com.—no par	f 54	48½	55½
Fairbanks Morse, com.	f 51½	32½	54½
Fairbanks Morse, pf.	f 110½	106½	110½
Federal Lt. & Trac., com.	f 32½	26	36
Federal Light & Traction, pf.	l 85½	82½	86½
Federal Utilities, pf.	f 75	....	....
Federal Utilities, com.	f 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	k105	99½	107½
Galveston-Houston Elec., 6% pf.	64	70	75
Galveston-Houston Elec., com.—no par	25	20	40
Gen. Elec., com.	f 524	227½	337½
Gen. Elec., special—10	f 11½	10½	11½
Gen. Gas & Elec., 6% pf.—no par.	l 220	72	240
Gen. Gas & Elec., 7% pf.	l 165	120	175
Gen. Gas & Elec., com.—no par.	l 200	72	240
Gen. Gas & Elec., (Me.) pf.—$7—no par	l 130	90	175
Gen. Gas & Elec., (Me.) pf.—$8—no par.	l 140	104½	180
Gen. Gas & Elec. (Del.) com. A no par.	a 84	42	64½
Gen. Gas & Elec. (Del.) com. B no par.	50	40	62
Gen. Gas & Elec. (Del.) A pf. 7% no par.	95	87½	100
Gen. Gas & Elec. (Del.) A pf. 8% no par.	107	90	110
Gen. Gas & Elec. (Del.) B pf. 7% no par.	94	88	95
Ga. Lt., Pwr. & Rys., 6% pf.	75	74	85
Ga. Lt., Pwr. & Rys., com.	60	25	74
Ga. Ry. & Elec. .5% pf.	l 76	78½	84½
Ga. Ry. & Elec. .com.	l 124½	115½	115½
Ga. Ry. & Pwr., 8% pf.	f 112	....	....
Ga. Ry. & Pwr., 7% pf.	f 101	....	....
Ga. Ry. & Pwr., 4% pf	128	62	140
Ga. Ry. & Pwr., com.	137	62	145
Gt. Western Pwr., 7% pf.	h 101	....	....
Havana Elec. Util., com.	42	42	45
Havana Elec. Util., pf.	69½	66	70½
Hurley Machine, com.—no par.	a 52½	41½	56
Idaho Pwr., 7% pf.	100½	97½	102
Ill. No. Utilities, 6% pf.	88	82	92
Ill. Pwr. & Lt., 7% pf.	96½	92½	98
Int. Combustion Engr., com.—no par	f 67½	31½	69½
Int. Utilities, class A—no par.	f 39	....	....
Int. Utilities, class B—no par.	f 8	....	....
Interstate Pwr., pf., $7, no par.	90	90	95
Interstate Pub. Serv., 7% pf.	96	90	100
Iowa Ry. & Lt., 7% pf.	97	92	100
Jersey Central Pwr. & Lt., 7% pf.	94	90	96
Jersey Central Pwr. & Lt., com.—no par	45	15	50
Johns-Manville, com.—no par.	f 167	....	....
Kansas Gas & Elec., 7% pf.	k102	97½	103
Kelvinator Corp., com.—no par.	f 79	....	....
Kentucky Hydro-Elec., com.	a 93½	85½	94
Kentucky Sec., 6% pf.	74	67	78
Kentucky Sec., com.	82	77	87
Kentucky Utilities, 6% pf.	89	82	95
Kings County Ltg., 7% pf.	f 100	....	....
Laclede Gas Lt., com.	156	110½	173
Lehigh Pwr. Sec., cap.—no par.	180	82	188

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh. fBid, low, high, Tuesday, Dec. 8. kBid, low, high, Wednesday, Dec. 9. lLatest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Saturday, Dec. 5	Low 1925	High 1925
STOCKS—Continued			
Long Island Ltg., 7% pf.	105	100	105
Long Island Ltg., com—no par.	135	60	142
Los Angeles Gas & Elec., 6% pf.	95	90	98
Manila Elec., com.—no par	*f* 35	28½	49
Maytag Mfg., com.	*f* 22½	21½	26½
Memphis Pwr. & Lt., pf., $7, no par.	102	98½	102
Metropolitan Edison, pf.—$6—no par	92½	92	96
Metropolitan Edison, pf., $7, no par.	104	100	110
Middle West Utilities, 7% pf.	*a* 97½	91½	98½
Middle West Utilities, 7% pr. lien pf.	*a*107	98	108
Middle West Utilities, com.—no par	*a*115½	92½	125
Midland Utilities, pr. ln. pf.	*a*100	98½	101
Milwaukee Elec. Ry. & Lt., 8% pf.	100	98	105
Milwaukee Elec. Ry. & Lt., 7% pf.	98	96	105
Milwaukee Elec. Ry. & Lt., 6% pf.	86½	83½	87
Minn. Pwr. & Lt., 7% pf.	*k*101	97½	102
Miss. Pwr. & Lt., pf.	*f*100	....	....
Miss. River Pwr., 6% pf.	95	87½	94
Miss. River Pwr., com.	60	37	124½
Montana Pwr., pf.	*l*112½	109	117
Montana Pwr., com.	*f*83½	64	99½
Montreal Pwr., com.	*f* 215½	....	....
Mountain States Pwr., pf.	*f* 94	....	....
Mountain States Pwr., com.	*f* 27	....	....
National Carbon, com.	*l*124	120	130
National Carbon, pf.	*l*125	120	130
National Elec. Pwr., pf.	*a* 94½	94	96½
National Lt., Ht. & Pwr., 5% pf.	71	40	72
National Lt., Ht. & Pwr., com.—no par	24	11	30
National Pwr. & Lt., pf., $7—no par	102	95	99
National Pwr. & Lt., com.—no par.	430	185	467
National Pub. Serv., 7% pf.	*f* 91½	....	....
National Pub. Serv., pfc. pf.	*f* 98	....	....
National Pub. Serv., A com.—no par	*f* 23½	....	....
National Pub. Serv., B com.—no par	*f* 14½	....	....
Nebraska Pwr., 7% pf.	*k*102	98½	103½
Nevada-Calif. Elec., com.	37	31	58
N. J. Pwr. & Lt., 7% pf.	104	92	102
New Orleans Pub. Serv., 7% pf.	101	94	102
New Orleans Pub. Serv., com.—no par	*l* 30	31	38½
N. Y. Central Elec., 7% pf.	97	96	101
Niagara Falls Pwr., 7% pf.—25	*f* 27½	27½	29
Niagara, Lock. & Ont. Pwr., 7% pf.	*l* 106	101½	110
Niagara, Lock. & Ont. Pwr., com.—no par.	*l* 60½	60	73
NizerCorp., A.—no par.	80½	37	84
NizerCorp., B.—no par.	*f* 80½	....	....
No. Amer., 6% pf.—50	*f* 49½	46½	50½
No. Amer., com.—10.	*f* 68½	41½	75
No. Caro. Pub. Serv., pf.—$7—no par.	90	90	96
No. N. Y. Utilities, 7% pf.	*f*102½	....	....
No. Ohio Pwr., com.—no par.	14	5	19
No. Ohio Trac. & Lt., 6% pf.	73	64	75
No. Ont. Lt. & Pwr., pf.	75	68	78
No. Ont. Lt. & Pwr., com.	48	41	52
No. States Pwr., 7% pf.	100	95	100
No. States Pwr. com.	139	103	144½
No. Texas Elec., 6% pf.	50	60	75
No. Texas Elec., com.	40	40	70
Ohio Gas & Elec., 7% pf.	90	87	100
Ohio Pwr., 6% pf.	93	85	95
Ohio Pub. Serv., 7% pf.	98	97	100
Ohio River Edison, 7% pf.	97	93½	100½
Oklahoma Gas & Elec., pf.	*f* 93	....	....
Pacific Gas & Elec., 6% pf.	97	92	99
Pacific Gas & Elec., com.	*f*134	102½	137½
Pacific Pwr. & Lt., 7% pf.	*k*98½	97½	102
Parr Shoals Pwr., 6% pf.	92	90	100
Penn Central Lt. & Pwr., pf.—no par	*l* 72	60	72
Penn-Ohio Elec., 7% pf.	93	83½	96
Penn-Ohio Pwr. & Lt., 7% pf.	97	91	100
Penn-Ohio Pwr. & Lt., 8% pf.	103	101	110
Penn Pwr. & Lt.—$7—no par.	*k*105	98½	106½
Penn Pub. Serv., 7% pf.	96	90	100
Penn Pub. Serv., 6% pf.	85	80	90
Penn Wtr. & Pwr., cap.	*e*165	126½	185
Phila. Co., (Pitts.) pf.—50	*c* 47½	37½	49½
Phila. Co., (Pitts.) com.—50	*c* 60½	52½	60½
Phila. Elec., com.	*c*46½	37½	49½
Pittsburgh Utilities, pf.	*f* 15½	12½	17½
Portland Elec. Pwr., 7% pf.	98	95	99
Portland Elec. Pwr., 6% pf.	72	70	80
Portland Elec. Pwr., com.	40	40	53
Portland Ry., Lt. & Pwr., pf.	*l* 72	....	....
Portland Ry., Lt. & Pwr., com.	*l* 41	....	....
Pwr. Corp. of N. Y., 7% pf.	*l*110	96	112
Pwr. Corp. of N. Y., com—no par	73	15	89½
Pwr. Sec., pf —no par.	20	20	55
Pwr. Sec., com.—no par.	14	8	30
Pub. Serv. of N. J., 7% pf.	105	99	106
Pub. Serv. of N. J., 8% pf.	115	108½	119
Pub. Serv. of N. J., com—no par.	*f* 80½	62½	87½
Pub. Serv. of No. Ill., 6% pf.	*a*100	92	100
Public Serv. of No. Ill., 7% pf.	*l*111	102	111
Pub. Serv. of No. Ill., com.—no par	*a*129½	107½	129½
Pub. Serv. of No. Ill., com.	125	97	124
Pub. Serv. of Okla., 7% pf.	93	87	95
Pub. Serv. Elec. & Gas, 6% pf.	*f* 99	92½	99½
Puget Sound Pwr. & Lt., 7% pf.	106	102½	107
Puget Sound Pwr. & Lt., 6% pf.	*f* 84	....	....
Puget Sound Pwr. & Lt., com.	48	49	61
Radio Corp., of Amer., pf.—50	*f* 46	45½	54
Radio Corp. of Amer., com.—no par	*f* 48	39½	77½
Republic Ry & Lt., pf.	88	70	85
Republic Ry. & Lt., com.	62	49	65
Rochester Gas & Elec., 5% pf.	95	80	98
Servel Corp., Class A.	*f* 31½	....	....
Servel Corp., Class B—no par	56	35	62½
Sierra Pacific Elec., com.	*f* 25	....	....
Sioux City Gas & Elec., 7% pf.	*f* 99	....	....
Southeastern Pwr. & Lt., 7% pf—no par.	97	90	100
Southeastern Pwr. & Lt., com—no par	30½	28	34½
So. Calif. Edison, 8% pf.	135	115	128
So. Calif. Edison, 7% pf.	110½	105	107½
So. Calif. Edison, 6% pf.	99	90	95½
So. Calif. Edison, com.	132	102	149
Southern Cities Utilities, 7% pf.	81	77	100
Southern Cities Utilities, com.	40	30	71
Southern Pwr. & Lt. of Md., pf.	*f*107	....	....
Southern Pwr. & Lt. of Md., com.	*f* 32	....	....
Southwestern Pwr. & Lt., A.	*f* 50	....	....
Southwestern Pwr. & Lt., B.	31	....	....
Southwestern Pwr. & Lt., 7% pf.	100	90	102
Springfield (Mo.) Ry. & Lt., 7% pf.	96	92	93
Standard Gas & Elec., 8% pf.	*f* 55	50½	56½
Standard Gas & Elec., 7% pf.	100½	96	100
Standard Gas & Elec., com.—no par	*f*58½	40½	61
Standard Pwr. & Lt., 7% pf.	108	95	114½
Superheater, com.—No par.	142	120	152
Tampa Elec., com.	*f*278	....	....
Tenn. Elec. Pwr., 6% pf.	84	80	85
Tenn. Elec. Pwr., 7% pf.	99	93	103
Tenn. Elec. Pwr., pf.—$6—no par.	*f* 80	72	84
Tenn. Elec. Pwr., com.—no par.	*f* 65	....	....
Tex. Pwr. & Lt., 7% pf.	*k*102	99½	106
Tide Water Pwr., 8% pf.	*f*98	....	....
Timken Roller Bearing, com.	*f*54	37½	59½
Toledo Edison, 8% pf.	113	109	114
Toledo Edison, 7% pf.	101	94	101½
Toledo Edison, com.	25	21	25
Tri-City Ry. & Lt., 6% pf.	87	82	85
United Gas & Elec., 6% pf.	92	80	94
United Gas & Elec., com.—no par.	55	26	57½
United Gas & Elec. (N. J.), 5% pf.	65	55	65
United Gas Impr.—50	*c*117½	79½	120½
United Lt. & Pwr., pf.—$4—no par	50	41	51
United Lt. & Pwr., pf.—$6.50—no par.	92	83	99
United Lt. & Pwr., com., A—no par.	148	42	166½
United Lt. & Pwr., com., B—no par.	160	49	100
Utah Pwr. & Lt., 7% pf.	*k* 99	97½	101½
Utica Gas & Elec., 7% pf.	103	100	104
Utica Gas & Elec., com.	200	100	200
Utilities Pwr. & Lt., 7% pf.	92	90	97
Utilities Pwr. & Lt., com. B—no par	18½	12	22
Vermont Hydro-Elec., 7% pf.	92	87	96
Virginia Pwr., 7% pf.	99	94	107
Virginia Pwr., com.	65	65	92
Virginia Ry. & Pwr., com.	*l*149	64½	150
Wagner Elec., pf.	*b* 85	79	92
Wagner Elec., com.—no par	*b* 34	26½	50
Washington Wtr. Pwr., com.	129	110	140
West Mo. Pwr., 7% pf.	*f* 91	....	....
West Penn., 7% pf. tem. ctf	*l*96	94	100
West Penn., com.	*f*122½	97	145
West Penn Pwr., pf.	*f*108	104	111
West Virginia Lt., Ht. & Pwr., 7% pf.	94	94½	96½
West Va. Utilities, 7% pf.—50	41	38	47
Western Elec., 7% pf.	*k* 83	110	117½
Western Pwr., 7% pf.	*l*96	84	....
Western Pwr., com.—no par	80	34	102
Western States Gas & Elec., 7% pf.	88	82	92
Western States Gas & Elec., com.	*f* 19	....	....
Westinghouse Elec. & Mfg., com.—50	*f* 74½	66½	84
Weston Elec. Instrument, Cl. A.	*f* 28½	19½	28½
Weston Elec. Instrument, com.	*f* 19½	9½	20½
Wis.-Minn. Lt. & Pwr., 7% pf.	*l* 90	92	95
Wis. Pwr., Lt. & Ht., 7% pf.	85	85	90
Worthington Pump, pf. A	79½	76	88
Worthington Pump, pf. B.	62½	58	76½
Worthington Pump, com.	*f* 45	35½	79½
Yadkin River Pwr., 7% pf.	*k*103	98	106
Yale & Towne, com.—25	*f* 66	62	70½
BONDS			
Abitibi Pwr. & Paper	6s 1940	100	98	101½
Adir. Elec. Pwr.	5s 1962	99½	97½	100½
Adir. Pwr. & Lt.	6s 1950	104½	102½	105½
Adir. Pwr. & Lt.	5s 1930	97	94	98
Ala. Pwr.	5s 1946	98½	96	100
Ala. Pwr.	5s 1951	95½	92½	97½
Ala. Pwr.	6s 1951	104½	101½	105
Ala. Trac. Lt. & Pwr.	5s 1962	105½	86	109
Aluminum Co. of Amer.	7s 1933	106½	106½	107½
Amer. Bosch Magneto	8s 1936	*l* 103	86	101
Amer. Gas & Elec.	5s 2007	91	90	93½
Amer. Gas & Elec.	6s 2014	98½	96½	99
Amer. Pwr. & Lt.	6s 2016	94½	94	98
Amer. Fub. Serv.	6s 1942	98½	94	99½
Amer. Wtr. Wks. & Elec.	5s 1934	97	92½	98
Amer. Wtr. Wks. & Elec.	6s 1975	94½	94½	95
Anaconda Copper	6s 1929	103	102½	104
Anaconda Copper	6s 1953	101½	99½	102
Anaconda Copper	7s 1938	104½	99½	105½
Appalachian Pwr.	5s 1941	98½	96	99½
Appalachian Pwr.	6s 2024	93½	86½	94½
Appalachian Pwr.	7s 1936	106	105½	106½
Arizona Pwr.	6s 1933	100	97½	101
Arizona Pwr.	6s 1947	95½	90	96
Ark. Central Pwr.	6s 1948	100½	98½	102½
Ark. Lt. & Pwr.	6s 1945	103	100	104½
Ark. Lt. & Pwr.	6s 1954	98½	92½	99½
Assoc. Gas & Elec.	6s 1965	94½	92	96
Assoc. Gas & Elec.	6½s 1954	100½	94½	106
Binghamton Lt., Ht. & Pwr.	5s 1946	98½	94½	99
Birmingham Elec.	6s 1954	101½	99	103
Birmingham Ry., Lt. & Pwr.	4½s 1954	87½	85	89½
Broad River Pwr.	6½s 1934	100	99	102
Brooklyn Edison	5s 1949	102	99½	103
Brooklyn Edison	6s 1930	104	103½	106
Buffalo Gen. Elec. 1st	5s 1939	101½	100½	102
Buffalo Gen. Elec. 1st & Ref.	5s 1939	101	100	100½
Burlington Ry. & Lt.	5s 1932	94½	90	96
Butte Elec. & Pwr.	5s 1951	100	99	100½
Calif. Gas & Elec.	5s 1937	100½	98	101½
Canadian Lt. & Pwr.	5s 1949	42	36	62
Canton Elec.	5s 1937	99½	99	100½
Carolina Pwr. & Lt.	5s 1938	99½	98½	100½
Carolina Pwr. & Lt.	6s 1953	104½	103½	105
Cedar Rapids Mfg. & Pwr.	5s 1953	99	98½	100½
Central Ark. Ry. & Lt.	5s 1928	99	98½	100
Central Ga. Pwr.	5s 1938	95½	93	97
Central Ill. Lt.	5s 1943	98½	94	99½
Central Ill. Publ Serv.	5s 1952	89½	84½	92½
Central Ill. Pub. Serv.	5½s 1950	96	96½	98
Central Ill. Pub. Serv.	6s 1944	100	96½	101½
Central Ind. Pwr.	6s 1947	98½	95½	99½
Central Ia. Pwr. & Lt.	6s 1944	99	97	100½
Central N. Y. Gas & El.	5s 1941	96½	94	97
Central Pwr. & Lt.	6s 1946	100½	97½	101½
Central Pwr. & Lt.	6½s 1952	101½	94	102½
Central States Elec.	5s 1926	*l* 99	98	102½
Chattanooga Ry. & Lt.	5s 1956	84	81	85
Cincinnati Gas & Elec.	5s 1956	102	98½	102½
Cincinnati Gas & Elec.	5½s 1967	103½	100½	105
Cities Service	6s 1966	91	90	91½
Cities Service	7s B 1966	*f*178	....	....
Cities Service	7s C 1966	126½	111	128
Cities Service	7s D 1966	101½	98½	106½
Cities Service	7s E 1966	*f*111	....	....
Cities Service Pwr. & Lt.	6s 1944	93½	93½	95
City Lt. & Trac., Sedalia, Mo.	5s 1952	84	74	85½
Cleveland Elec. Illum.	5s 1939	101½	100	102
Cleveland Elec. Illum.	5s 1954	100½	97½	101
Cleveland Elec. Illum.	7s 1941	110	109	111½
Colorado Pwr.	5s 1953	95	93	96½
Columbia Gas & Elec.	5s 1927	99½	99½	100½
Columbia Ry., Gas & El.	5s 1936	92	92½	94½
Columbus, Dela. & Marion Elec.	5s 1937	85	83	88
Columbus, Dela. & Marion Elec.	6s 1937	95	91	98
Columbus Elec. & Pwr.	6s 1947	*f*102	....	....
Columbus Ry., Pwr. & Lt.	5s 1940	95½	93½	98
Columbus Ry., Pwr. & Lt.	6s 1941	103	101½	105
Commonwealth Edison	5s 1943	102	99½	102½
Commonwealth Edison	5s 1953	99½	98½	101
Commonwealth Edison	5s 1954	99½	98	101
Commonwealth Pwr.	6s 1947	102½	97½	103½
Community Pwr. & Lt.	6s 1950	a6	94½	98
Conn. Ry. & Ltg.	4½s 1951	*l* 87	90½	92½
Consol. Cities, Lt., Pwr. & Trac.	5s 1962	80	75½	82½
Consol. Elec.	5s 1955	97	94	98½
Consol. Gas of N. Y.	5½s 1945	*l*104½	101½	105
Con. Gas, Elec. Lt. & Pwr. of Balti.	4½s 1935	*l* 97½	93½	97½
Con. Gas, Elec. Lt. & Pwr. of Balti. (notes)	6s 1949	105½	104½	108
Con. Gas, Elec. Lt. & Pwr. of Balti.	5½s 1952	*k*104	101½	105½
Con. Gas, Elec. Lt. & Pwr. of Balti.	5s 1965	*e*99½	99	100½
Con. Gas, Elec. Lt. & Power of Baltimore	5½s 1952	*l*104	101½	105½
Consumers Elec. Lt. & Pwr.	5s 1936	94½	93	96½
Consumers Pwr.	5s 1936	100	99	100½
Consumers Pwr.	5s 1952	97½	90½	100
Consumers Pwr.	5½s 1954	103	99	104½
Continental Gas & Elec.	5s 1927	100	99½	100½
Continental Gas & Elec.	6s 1947	99	98	101
Continental Gas & Elec.	6½s 1964	98½	96½	101
Continental Gas & Elec.	7s 1954	104½	99	103½
Cumberland County Pwr. & Lt.	5s 1942	94½	92	96½
Dallas Pwr. & Lt.	6s 1949	104½	103	105½
Dayton Ltg.	5s 1937	99½	98½	100½
Dayton Pwr. & Lt.	5s 1941	99½	97	100½
Defiance Gas & Elec.	5s 1942	95	88½	97½
Denver Gas & Elec.	5s 1949	97½	97½	100
Denver Gas & Elec. Lt.	5s 1951	93	92	95½
Des Moines Elec.	5s 1938	98	98	100½
Detroit Edison	5s 1933	100½	99½	102½
Detroit Edison	5s 1940	102	99½	102½
Detroit Edison	5s 1949	100½	97½	101½
Detroit Edison	5s 1955	99½	99½	100½
Detroit Edison	6s 1932	134½	110½	155
Detroit Edison	6s 1940	*l*107½	106½	108½
Detroit Edison	7s 1928	*l*115½	125	156½
Detroit Edison	7s 1929	136	114	150½
Detroit Edison	7s 1930	136	121½	158½
Dominion Pwr. & Trans.	5s 1932	95½	95½	98½
Driver-Harris	8s 1931	96	88	97
Dubuque Elec.	6s 1942	101½	97½	102
Duke-Price Pwr.	6s 1949	101	98½	103
Duquesne Lt.	6s 1949	106	104½	107½
Duquesne Lt.	5½s 1949	104½	104	106
Durham Pub. Serv.	7s 1949	100	97½	101½
East Penn. Elec.	6s 1953	104½	100½	105½
East Oregon Lt. & Pwr.	6s 1929	100	97½	100½
East. Tex. Elec.	5s 1942	*j* 95	....	....
Economy Lt. & Pwr.	5s 1956	98½	96	99½
Edison Elec. Illum. of Bkln.	4s 1939	92½	89	96
Edison Elec. Illum. (N. Y.)	5s 1995	102½	99½	103
El Paso Elec.	5s 1932	*f*102	....	....
El Paso Elec.	5s 1950	*j* 95½	....	....
Elec. Pwr. Corp. (Germany)	6½s 1950	87½	86½	88½
Elmira Wtr., Lt. & R. R.	5s 1956	95	92½	96½
Empire Dist. Elec.	5s 1949	91	86½	91½
Erie Ltg.	5s 1967	98	95½	99½
Evansville Gas & Elec. Lt.	5s 1932	98½	96	100
Federal Lt. & Trac.	5s 1942	91½	88	96
Federal Lt. & Trac.	6s 1942	101	96½	103
Federal Lt. & Trac.	6s 1954	92½	91½	94½
Ft. Smith Lt. & Trac.	5s 1936	78	76½	82½
Ft. Worth Pwr & Lt.	5s 1931	99½	99	100½
Galveston Elec.	5s 1940	91	86½	93½
General Elec.	3½s 1942	87½	83	90½
Georgia Carolina Pwr.	5s 1952	85½	82	90
Ga. Lt., Pwr. & Rys.	5s 1941	87	86½	90½
Ga. Ry. & Elec.	5s 1932	98½	98½	100½
Ga. Ry. & Elec.	5s 1949	92	88	94½
Ga. Ry. & Pwr.	5s 1954	93½	89½	96
Ga. Ry. & Pwr.	6s 1947	102½	100½	103½
Ga. Ry. & Pwr.	7s 1941	104½	105	107
German Gen. Elec.	7s 1945	95½	92	96½
Great Cons. Elec. Pwr (Japan)	6½ 1950	85½	85½	86½
Great Cons. Elec. Pwr. (Japan)	7s 1944	90½	87½	92
Great Falls Pwr.	5s 1940	103½	99½	103½
Great Northern Pwr.	5s 1935	98½	96	99
Great Western Pwr.	5s 1946	98½	95	99½
Great Western Pwr.	5½s 1955	98½	96	99½
Great Western Pwr.	6s 1949	101½	100	102½
Great Western Pwr.	6s 1952	101½	99½	102½
Hamburg Elec.	7s 1935	96	95½	96
Havana Elec. Ry., Lt. & Pwr.	5s 1954	92½	85½	95½
Holtwood Pwr.	6s 1954	103½	100	104½
Houston Ltg. & Pwr.	5s 1931	99½	98½	100
Houston Ltg. & Pwr.	5s 1953	93½	90½	95½
Houston Ltg. & Pwr.	5½s 1954	101½	97	102½
Hydraulic Pwr.	5s 1951	101	99½	102
Hydraulic Pwr.	5s 1950	101	100	103
Idaho Pwr.	5s 1947	96½	93	97½
Ill. Elec. Pwr.	6s 1943	102	99½	103½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh. *j*Bid, low, high, Tuesday, Dec. 8. *k*Bid, low, high, Wednesday, Dec. 9. *l*Latest quotations available.

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies			Bid Price Saturday, Dec. 5	Low 1925	High 1925
BONDS (Continued)					
Ill. Pwr.	5s	1933	93½	93	95½
Ill. Pwr. & Lt.	6s	1953	101½	100½	102½
Ill. Pwr. & Lt.	7s	1953	103	99	102½
Ind. Elec.	6s	1947	98	97	99½
Ind. Gen. Serv.	5s	1948	95½	92	97½
Ind. Lighting	4s	1958	80½	78	83
Indiana & Mich. Elec.	5s	1957	98½	97½	99½
Indiana & Mich. Elec.	5s	1955	95½	95	98
Ind. Pwr.	7⅛s	1941	*105½	104	106
Ind. Service	5s	1950	89½	86½	92
Ind. Service	6s	2020	85	73	88½
Ingersoll-Rand	5s	1935	99½	92	99½
Interstate Elec.	6s	1933	95	95	99½
Interstate Pwr.	6s	1944	98	95	99½
Interstate Pwr.	7s	1934	101	97	101
Interstate Pub. Serv.	6s	1948	98	96	100½
Iowa Ry. & Lt.	5s	1932	97½	97	99½
Jersey Cent. Pwr. & Lt.	5½s	1945	95½	95	98
Kansas City Pwr. & Lt.	5s	1952	99½	95½	102
Kansas Elec. Pwr.	6s	1937	100½	97½	102
Kansas Elec. Pwr.	6s	1943	100½	97½	102
Kansas Gas & Elec.	6s	1952	102	98½	103½
Kansas Gas & Elec.	6s	2022	92	86½	94½
Kentucky Utilities	6s	1949	100½	97	101½
Kings County Elec. Lt. & Pwr.	5s	1937	102½	99	103
Kings County Elec. Lt. & Pwr.	6s	1997	119½	114½	120½
Kings County Ltg.	5s	1954	98½	89	101½
Kings County Ltg.	6½s	1954	107½	103½	108½
Knoxville Ry. & Lt.	5s	1946	93½	88	95½
Laclede Gas Lt.	5s	1934	100½	98½	101½
Laclede Gas Lt.	5½s	1953	101½	95½	102
Laurentian Pwr.	6s	1936	100	96	100½
Laurentide Pwr.	6s	1936	ƒ99	96	100
Laurentide Pwr.	5s	1946	99	97	100½
Laurentide Pwr.	6s	1936	ƒ99	...	...
Lehigh Pwr. Sec. (notes)	6s	1927	100½	100½	101½
Lincoln Gas & Elec.	5s	1941	91	92½	95½
Long Island Ltg.	5s	1936	99½	98½	100½
Long Island Ltg.	6s	1954	99½	99½	102
Long Island Ltg.	6s	1948	104½	102	105½
Los Angeles Gas & Elec.	5s	1939	99	98	101½
Los Angeles Gas & Elec.	5½s	1943	98	94	99½
Los Angeles Gas & Elec.	5½s	1947	98½	96	99½
Los Angeles Gas & Elec.	5½s	1949	98	95½	99½
Los Angeles Gas & Elec.	6s	1942	102½	101½	104½
Louisiana Pwr.	6s	1944	97½	97	99
Louisville Gas & Elec.	5s	1952	97½	90½	99½
Louisville Gas & Elec.	5½s	1954	101½	99	102
Lower Austrian Hydro Elec.	6½s	1944	86	85½	86½
Luzerne County Gas & Elec.	5s	1948	98	97	99½
Luzerne County Gas & Elec.	7s	1944	104½	99½	104½
Luzerne County Gas & Elec.	6s	1954	102½	99	105
Madison River Pwr.	5s	1935	100 ☐	99½	101
Manila Elec.	7s	1942	101½	97½	103
Manila Elec. Ry. & Ltg.	5s	1953	89	85	92
Manitoba Pwr.	7s	1941	103	98½	104½
Memphis Pwr. & Lt.	5s	1948	98½	95	99½
Metropolitan Edison	6s	1952	103½	101½	106½
Metropolitan Edison	5s	1953	95½	91½	97
Metropolitan Pwr.	6s	1953	102½	100	104
Michigan Lt.	5s	1946	98	97½	100
Michican No. Pwr.	5s	1941	96	95½	97
Milwaukee Elec. Ry. & Lt.	5s	1926	100	99½	101½
Milwaukee Elec. Ry. & Lt.	4½s	1931	96½	94½	97
Milwaukee Elec. Ry. & Lt.	5s	1951	98½	94	100
Milwaukee Elec. Ry. & Lt.	5s	1961	89½	84½	92½
Milwaukee Elec. Ry. & Lt.	6s	1953	101	98½	104
Minn. Pwr. & Lt.	5s	1955	95	95	97
Minn. Pwr. & Lt.	6s	1950	103½	101½	105½
Miss. River Pwr.	5s	1951	99	96½	100½
Miss. River Pwr.	7s	1935	102	102	104
Mo. Edison Elec.	5s	1927	*99½	99½	100½
Mobile Elec.	5s	1946	96	91	97½
Montana Pwr.	5s	1943	100½	97½	100½
Montgomery Lt. & Wtr. Pwr.	5s	1943	*93	86½	93½
Montreal Lt., Ht. & Pwr.	4½s	1932	97	97	98½
Montreal Lt., Ht. & Pwr.	5s	1933	98½	98½	101
Montreal Pub. Serv.	5s	1942	94½	89	94½
Mountain States Pwr.	6s	1938	98½	96½	100½
Nashville Ry. & Lt.	5s	1953	97½	94	98
Nashville Ry. & Lt.	5s	1958	90	84	88½
Nassau Lt. & Pwr.	5s	1927	99½	98	101
Nassau & Suffolk Ltg.	5s	1945	89	82	91
National Pwr. & Lt.	7s	1972	102½	97	104½
National Pub. Serv.	6½s	1955	94	94	96½
Nebraska Pwr.	5s	1949	100	97	100½
Nebraska Pwr.	6s	2022	95½	89½	97½
Nevada-Calif. Elec.	6s	1946	98½	96½	100½
Nevada-Calif. Elec.	6s	1950	98½	96½	100½
New England Pwr.	5s	1951	101	100½	103
New Jersey Pwr. & Lt.	5s	1936	96½	92½	97½
New Orleans Pub. Serv.	4½s	1935	86½	83½	88½
New Orleans Pub. Serv.	5s	1952	90½	89½	92
New Orleans Pub. Serv.	5s	1955	90½	88½	92½
New Orleans Pub. Serv.	6s	1949	89	86½	93½
N. Y. & Queens Elec. Lt. & Pwr.	5s	1930	100	99½	101
N. Y. & Westchester Ltg.	4s	2004	78	76	81
N. Y. & Westchester Ltg.	5s	1954	96	93	97
New York Edison	6½s	1941	114½	112	115½
New York Edison	5s	1944	101½	99½	102
N. Y. Gas & Elec. Lt., Ht. & Pwr.	5s	1948	103½	100½	104½
N. Y. Gas & Elec. Lt., Ht. & Pwr.	4s	1949	88½	86	90½
N. Y. State Gas & Elec.	5½s	1962	100½	96	101½
Newport News & Hampton Ry., Gas & Elec.	5s	1944	85	84	93
Niagara Falls Pwr.	5s	1932	101	99½	103
Niagara Falls Pwr.	6s	1932	105½	103½	106½
Niagara Falls Pwr.	6s	1950	105½	105½	106½
Niagara, Lock. & Ont. Pwr.	5s	1954	*98½	104½	110
Niagara, Lock. & Ont. Pwr.	5s	1955	98½	97½	100
Niagara, Lock. & Ont. Pwr.	6s	1958	*109½	104½	110½
Norfolk Ry. & Lt.	5s	1949	94	93	95½
No. Amer. Edison	6s	1952	102½	96½	102½
No. Amer. Edison	6½s	1948	104½	100½	106
No. Amer. Lt. & Pwr.	7s	1954	99½	97	100½
North Caro. Pub. Serv.	5s	1934	90½	89	93½
North Caro. Pub. Serv.	6s	1954	94	91½	96
North Caro. Pub. Serv.	6½s	1944	98	96	100
North Shore Elec.	5s	1940	99½	97½	100
No. Calif. Pwr.	5s	1948	99½	98½	100½
No. Ind. Gas & Elec.	5s	1929	99	97	100½
No. Ind. Gas & Elec.	6s	1952	102½	99½	103½
Northern N. Y. Utilities	5½s	1949	99	96½	100½
No. Ohio Trac. & Lt.	4s	1933	87	82	87½
No. Ohio Trac. & Lt.	5s	1956	83	78	83
No. Ohio Trac. & Lt.	6s	1926	99	98½	100
No. Ohio Trac. & Lt.	6s	1947	94½	91	97
No. Ontario Lt. & Pwr.	6s	1931	98½	95½	99½
No. States Pwr.	6½s	1933	136½	105½	141
No. States Pwr. (notes)	6½s	1933	103½	99½	104½
No. States Pwr.	6s	1948	102½	101	104½
No. States Pwr.	6s	1941	105½	103	107½
No. States Pwr.	5s	1941	97½	93	99½
No. Tex. Elec.	5s	1940	74	74	82½
Northwestern Elec.	6s	1935	101	101½	102½
Northwestern Pub. Serv.	6½s	1948	99	97½	100½
Ohio Pwr.	5s	1952	93	89½	96
Ohio Pwr.	6s	1953	103	101	104½
Ohio Pwr.	6s	2024	95½	88½	95½
Ohio Pwr.	7s	1951	106	105½	107½
Ohio Pub. Serv.	5s	1954	91½	87	93
Ohio Pub. Serv.	6s	1953	100½	99	101½
Ohio Pub. Serv.	7½s	1946	112½	108	112½
Ohio Pub. Serv.	7s	1947	110½	107½	111½
Ohio River Edison	6s	1948	101½	98½	104
Okla. Gas & Elec.	5s	1950	92½	91½	96
Okla. Gas & Elec.	6s	1940	96½	95½	98½
Ontario Pwr. of Niagara Falls	5s	1943	100½	98	100½
Ontario Transmission	5s	1945	99½	97	99½
Ozark Pwr. & Wtr.	5s	1952	76	75	79
Pacific Coast Pwr.	5s	1940	99	98	100
Pacific Gas & Elec.	5s	1942	98	93½	99
Pacific Gas & Elec.	5s	1955	*93½	94	95½
Pacific Gas & Elec.	5½s	1952	101½	99½	102½
Pacific Gas & Elec.	6s	1941	105½	103½	106½
Pacific Lt. & Pwr.	5s	1951	99½	98½	100½
Pacific Lt. & Pwr.	5s	1942	99½	98	101½
Pacific Pwr. & Lt.	5s	1930	100	98	100
Pacific Pwr. & Lt.	5s	1953	*96½	...	...
Parr Shoals Pwr.	5s	1952	92	92½	97
Paterson & Passaic Gas & Elec.	5s	1949	99½	96	100½
Penn Central Lt. & Pwr	6s	1953	103½	102	104½
Penn Edison	5s	1946	96½	93½	97
Penn Elec.	6½s	1954	98½	96	99½
Penn. Elec.	6s	1955	93½	91½	95
Penn Ohio Elec.	6½s	1938	105	99½	107½
Penn Ohio Pwr. & Lt.	5½s	1954	97½	95	99½
Penn Ohio Pwr. & Lt.	6s	1939	97½	94	99½
Penn Pwr. & Lt.	5s	1952	97½	95	98½
Penn Pwr. & Lt.	5s	1953	97½	95	98½
Penn Pwr. & Lt.	6s	1953	104½	102½	105½
Penn Pwr. & Lt.	7s	1951	105½	105½	107
Penn Pub. Serv.	5s	1954	95½	93	96½
Penn Pub. Serv.	6s	1947	104	103	105½
Penn Wtr. & Pwr.	5s	1940	101½	99½	102½
Penn Wtr. & Pwr.	5½s	1953	102½	100	103
Phila. Co.	6s	1944	103½	101½	105
Phila. Co.	5½s	1938	98½	93½	100
Phila. Co.	5s	1951	96	93½	97
Phila. Co.	5s	1949	*103½	93½	104
Phila. Elec.	6s	1941	*107½	106	108½
Phila. Elec.	5s	1966	*102½	100	104½
Phila Elec.	4s	1966	*85	83	85
Phila. Elec.	5s	1960	*101	100	104
Phila. Elec.	5½s	1947	*106½	103½	107
Phila. Elec.	5½s	1953	*106½	104½	107½
Portland Elec. Pwr.	6s	1947	99	96½	100½
Portland Gen. Elec.	5s	1935	99½	98½	100½
Portland Ry., Lt. & Pwr.	5s	1942	88½	84½	92
Portland Ry., Lt. & Pwr.	6s	1947	99	94	100½
Portland Ry., Lt. & Pwr.	7½s	1946	106½	104½	108
Potomac Edison	6s	1949	98	96	100
Potomac Edison	6½s	1948	102½	99	103½
Potomac Elec. Pwr.	5s	1929	99	99	100½
Potomac Elec. Pwr.	5s	1936	99½	98½	100
Power Corp. of N. Y.	6s	1942	100½	97	101½
Power Corp. of N. Y.	6½s	1942	104½	101½	105½
Power Securities	6s	1949	ƒ79	...	...
Pub. Lt. & Pwr.	5s	1945	68	64	79
Pub. Serv. Co. of Colo.	5½s	1954	93½	92	96
Pub. Serv. Co. of Colo.	6s	1953	98½	98	101
Pub. Serv. Co. of Colo.	7s	1933	101	98½	102½
Pub. Serv. Corp. of N. J.	5s	1959	104½	103½	105½
Pub. Serv. Corp. of N. J.	6s	1944	99½	95	99½
Pub. Serv. Co. of No. Ill.	5s	1956	96½	91	97½
Pub. Serv. Co. of No. Ill.	5½s	1962	101½	96½	102½
Pub. Serv. Co. of No. Ill.	5½s	1964	101½	96½	102½
Pub. Serv. Co. of Okla.	6s	1949	99	97½	101
Pub. Serv. Elec. & Gas.	5½s	1959	103½	98½	105½
Pub. Serv. Elec. & Gas.	5½s	1964	103½	99½	105
Public Utilities, (Evansville, Ind.)	6s	1929	100	99	101
Puget Sound Pwr.	5s	1933	98½	98½	100½
Puget Sound Pwr. & Lt.	5½s	1949	99½	96½	100½
Quebec Pwr.	6s	1953	102	98½	102½
Queensborough Gas & Elec.	5s	1952	99	96½	100½
Queensborough Gas & Elec.	6s	1953	104½	101	105½
Rhine-Westphalia Electric Power	7s	1950	94	94	95
Rio de Janeiro Tram., Lt. & Pwr.	5s	1935	93	85	93½
Robbins & Myers	7s	1952	59	57½	73½
Rochester Gas & Elec.	5½s	1948	104½	102½	105½
Rochester Gas & Elec.	7s	1946	112½	110	112½
Rochester Ry. & Lt.	5s	1954	100	99	101
Rockford Elec.	5s	1939	99½	98	101
St. Joseph Ry., Lt., Ht. & Pwr.	5s	1937	91	85½	93
St. Paul Gas Lt.	5s	1944	100	98½	101
St. Paul Gas Lt.	5½s	1954	101½	98	102½
Salt River Valley Wtr.	6s	1938	ƒ100	...	...
Salmon River Pwr.	5s	1952	100½	98½	101½
San Antonio Gas & Elec.	5s	1949	97	96	98½
San Antonio Pub. Serv.	6s	1952	101½	99½	104
San Diego Cons. Gas & Elec.	5s	1939	100	98	101
San Diego Cons. Gas & Elec.	6s	1939	101½	99	103
San Joaquin Lt. & Pwr.	5s	1945	98½	98	100
San Joaquin Lt. & Pwr.	6s	1950	102	101	103½
San Joaquin Lt. & Pwr.	6s	1952	101	99½	103½
San Joaquin Lt. & Pwr.	6s	1954	100½	99	101
Sauda Falls	5s	1955	98	98	98½
Savannah Elec. & Pwr.	7½s	1941	ƒ104½	....	....
Saxon Pub. Wks. (Germany)	7s	1945	92½	90½	94½
Scranton Electric	5s	1937	101½	99½	101½
Seattle Elec.	7s	1930	99½	99½	101
Seattle Elec.	5s	1929	100	99	100½
Seattle Elec.	5s	1939	92	90	93½
Seattle Ltg.	5s	1949	92	85½	93
Shawinigan Wtr. & Pwr.	5s	1934	100	100	101½
Shawinigan Wtr. & Pwr.	5½s	1950	103½	101½	104
Shawinigan Wtr. & Pwr.	6s	1950	105	104	106½
Siemens & Halske	7s	1928	96½	92½	99½
Siemens & Halske	7s	1935	95	90½	96½
Sierra & San Francisco Pwr.	5s	1949	77	75	80
Sierra & San Francisco Pwr.	6s	1949	90	87	93½
Sioux City Gas & Elec.	6s	1947	101½	99	102
Sioux City Gas & Elec.	6s	1949	101½	99	102
So. Caro. Gas & Elec.	6s	1942	84	87	93
So. Caro. Gas & Elec.	6s	1932	75	78	88
Southeast Pwr. & Lt.	6s	2025	89½	88	91½
So. Cal. Edison	5s	1939	99½	99½	101
So. Cal. Edison	5s	1944	95½	92½	96½
So. Cal. Edison	5½s	1944	101	98½	102
So. Cal. Edison	6s	1943	102	100½	104
So. Cal. Edison	6s	1944	104½	102½	105½
So. Cities Utilities	8s	1931	98	99	102
Southern Colo. Power	6s	1947	98½	93½	99½
So. Public Utilities	5s	1943	99½	97½	100½
So. Sierras Pwr.	6s	1936	102½	102	104½
So. Utilities	6s	1933	102	97½	102½
So. Wisconsin Pwr.	5s	1938	90½	88	93
Southwestern Gas & Elec.	5s	1932	96½	94	98
Southwestern Gas & Elec.	6s	1957	97	89	98
Southwestern Lt. & Pwr.	6s	1937	97½	94½	97½
Southwestern Pwr. & Lt.	5s	1943	94½	90	97
Southwestern Pwr. & Lt.	6s	2022	92½	88½	94½
Southwestern Utilities	8s	1936	96	96	102
Springfield Ry. & Lt.	5s	1926	99½	98½	100½
Standard Elec. of Cal.	5s	1939	98½	98½	100½
Standard Gas & Elec.	6s	1935	99½	91	101
Staten Island Edison	6½s	1953	104½	104	106½
Syracuse Ltg.	5s	1951	100	97½	101½
Syracuse Ltg.	5½s	1954	102½	100½	103
Tampa Elec.	5s	1933	ƒ99	....	....
Tenn. Elec. Pwr.	6s	1947	102½	99½	104½
Tenn. Pwr.	5s	1962	94½	90	96½
Tex. Pwr. & Lt.	5s	1937	98	97	99½
Tex. Pwr. & Lt.	6s	2022	95½	90	97½
Tide Water Pwr.	6s	1942	99½	98½	101
Tide Water Pwr.	7s	1937	99½	97½	101½
Toho Elec. Pwr. (Japan)	7s	1955	90½	87	91½
Tokyo Elec. (Japan)	6s	1928	98½	97½	99½
Toledo Edison	5s	1947	98½	97	100
Toledo Edison	7s	1941	108½	108½	110
Toledo Gas Elec. & Htg.	5s	1935	96½	97½	100½
Toledo Trac., Lt. & Pr. notes	5½s	1930	97½	97½	100½
Topeka Edison	5s	1930	98½	97	100
Topeka Ry. & Lt.	5s	1933	95	90½	96½
Trenton Gas & Elec.	5s	1949	99½	98	100
Tri-City Ry. & Lt.	5s	1930	98½	96½	99½
Twin State Gas & Elec.	5s	1953	96½	94	94½
Tyr 1 Hydro-Elec. Pwr.	7½	1955	96½	94½	97
Union Elec. Lt. & Pwr.	5s	1932	101½	99½	102
Union Elec. Lt. & Pwr.	5s	1933	100	98½	101
Union Elec. Lt. & Pwr.	5s	1954	99	97½	100
Union Elec. Lt. & Pwr.	5½s	1954	100½	100	104
United Elec. of N. J.	4s	1949	87½	85	88½
United Elec. Lt. & Pwr.	4½s	1929	*98½	98½	99
United Gas & Elec.	6s	1945	99	96	101
United Lt. & Pwr. notes	5½s	1928	99½	98	100
United Lt. & Pwr.	5½s	1959	94½	90½	97½
United Lt. & Pwr.	6½s	1974	97	92½	97½
United Lt. & Rys.	5s	1932	95½	92½	97½
United Lt. & Rys.	6s	1926	99½	100½	101½
United Lt. & Rys.	6s	1952	98½	95½	100½
United Lt. & Rys.	6s	1973	90	87	92
United Pwr. & Lt.	6s	1944	101½	99	103
Utah Lt. & Trac.	5s	1944	87½	83½	91½
Utah Pwr. & Lt.	5s	1944	95	91	98½
Utah Pwr. & Lt.	6s	1944	102½	102	104½
Utah Pwr. & Lt.	6s	2022	92½	88½	94½
Utica Elec. Lt. & Pwr.	5s	1950	101½	100½	102
Utica Gas & Elec.	5s	1957	100½	98½	103
Vermont Hydro-Elec.	6s	1929	100	98½	100½
Vicksburg Lt. & Trac.	5s	1932	91	89	93½
Virginian Pwr.	5s	1942	93½	88	96
Virginian Pwr.	6½s	1954	102	99	103
Virginia Ry. & Pwr.	5s	1943	98½	93½	99
Wagner Elec. Mfg.	7s	....	*101½	100	102
Washington Coast Util.	6s	1941	101½	99½	102
Washington Wtr. Pwr.	5s	1939	101½	99½	101½
West Penn Pwr.	5s	1963	99½	93½	100
West Penn Pwr.	5s	1946	99½	93½	100½
West Penn Pwr.	5½s	1953	104½	100½	105½
West Penn Pwr.	7s	1946	106½	104½	107½
West Virginia Lt., Ht. & Pwr.	6s	1929	100	95	100
West Virginia Utilities	6s	1935	94	91	98
Westchester Ltg.	5s	1950	101½	98	102
Western Elec.	5s	1944	100½	98	101½
Western N. Y. Utilities	5s	1946	96½	90½	97½
Western Pwr.	6½s	1954	100	97	101
West. States Gas & Elec.	5s	1941	97½	95	99½
West. States Gas & Elec.	6s	1947	99	97	100½
Westinghouse Elec. & Mfg.	7s	1931	106	105½	108½
Westphalia Un. Elec. Pr.	6½s	1950	*87½	87½	87½
Wisconsin Elec. Pwr.	5s	1954	98½	93½	99½
Wisconsin Gas & Elec.	5s	1952	99	97	100½
Wis.-Minn. Lt. & Pwr.	5s	1944	95½	93	96½
Wis. Ry., Lt. & Pwr.	5s	1933	92½	87½	93½
Wis. River Pwr.	5s	1941	90½	88	92½
Yadkin River Pwr.	5s	1941	98½	96½	99½
Yarmouth Lt. & Pwr.	5s	1937	83	82	87
Yarmouth Lt. & Pwr.	8s	1951	98	97	102

Stock Exchange: *Chicago; *St. Louis; *Philadelphia; *Boston; *Baltimore; *Montreal; *Cincinnati; *San Francisco; *Pittsburgh. ƒBid, low, high, Tuesday, Dec. 8. *Bid, low, high, Wednesday, Dec. 9. ‖Latest quotations available.